



# Web-Based Order Processing System for Via-Web Computer Co., Ltd.

by

Mr. Kasem Khasemputtaruengsri

A Final Report of the Three-Credit Course  
CS 6998 System Development Project

Submitted in Partial Fulfillment  
of the Requirements for the Degree of  
Master of Science  
in Computer Information Systems  
Assumption University

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Academic Year	March 2004

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The Graduate School of Assumption University has approved this final report of the three-credit course, CS 6998 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

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## ABSTRACT

This system development project presents the analysis and design of Sales Order Entry and Order Processing System for a web-based computer sales organization. The project is developed to solve the problems of order processing of the existing system. The objectives of this project are developed to provide a unique tool for structuring, managing, and tracking computer sales details.

The study of this project begins with the required definition and analysis of the existing system. Information system analysis and design tools are used to analyze both the existing system and the proposed system. Those tools are context diagrams, data flow diagrams, data dictionaries, and structure charts. Then, the candidate systems matrix solution is also used to compare various alternatives to come with most effective solutions. Finally, the capital budgeting models are used to evaluate the proposed system. Those models are cost-benefits analysis, break-even analysis, payback period analysis, net present value analysis, and return on investment analysis.

It was found that the new computerized system is implemented as a web-based application on Linux operating system with Apache HTTP web server, and PHP web programming language with MySQL database.

Based upon the payback period analysis, it shows that the initial investment will pay for itself after the period of 2 years and 6 months with net present value of 1,126,025.78 Baht and annual return on investment of 12.37%. In additional, the comparison on system cost between current cumulative system cost and the proposed cumulative system cost reveals the break-even point at the period of 2 years operation.

## ACKNOWLEDGEMENTS

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# I. INTRODUCTION

## 1.1 Background of the Project

Internet technology is radically changing people's daily lives. People use the Internet in several ways to retrieve the information and communicate with the others around the world. In the world of business, electronic commerce provides the corporation with many advantages. The manufacturer can distribute their products and services directly to the retail customers bypassing the intermediaries. The marketing department can use the interactive features of web page to hold the customers' attention to capture detailed information. Doing a business on the Internet, can be a new alternative way for a newly emerged company, because it requires less amount of initial investment.

This computer system development is intended to support the sales order entry and order processing of the web-based computer sales organization, named Via-Web Computer Company Limited, by developing the Sales Order Entry and Order Processing System, to study the exiting system and analyze the problem, then, design the sales order entry process and the order processing process, finally, map these processes to the web-based computerized Sales Order Entry and Order Processing System.

The record keeping system of Via-Web Computer Company Limited is mostly manual. They have an overwhelming workload in keeping the large amount of sales orders and order processing records. Within the project, the existing Sales Order Entry and Order Processing System is studied and analyzed together with all the business requirements as well as the user requirements, which will be used to design the new web-based computerized system.

With a new web-based computerized Sales Order Entry and Order Processing System, Via-Web Computer Company Limited will be able to provide better services to the customers. The company processing time in searching and keeping the customers data will be shortened which will improve the response time with the customers and provide the competitive edges over other competitors. Moreover, the new system will provide data, which is used to support decision making for the top management in the dynamic changes of the economy.

## **1.2 Objectives of the Project**

The objectives of developing the Sales Order Entry and Order Processing System for Via-Web Computer Company Limited are as follows:

- (1) Reengineering of the existing manual sales order entry and order processing system within 4 months.
- (2) Improving the back-office efficiency by implementing of the computerized back-office functionality in the company within 8 months.
- (3) Handling transaction volume predicted for the next 3 years.
- (4) Helping the company to take out routine redundant steps in the order processes by 50 percent and automate those tasks. All data of the customers are entered only once.
- (5) Sharing the data of the customers among the involved departments after the system is implemented.
- (6) Increasing time efficiency for the customers and decreasing by 50 percent, the time required completing a single customer transaction.
- (7) Releasing the staffs of the works overload by 50 percent, and enabling them to focus on after-sales services.
- (8) Eliminate keyboard data entry for as much as 50% of all orders.

- (9) For remaining orders, reduce as many keystrokes as possible by replacing keystrokes with point-and-click objects on the computer display screen.
- (10) Deploying the web-based sales order entry and sales processing system in a LINUX environment.

### **1.3 Scope of the Project**

This project will focus on the design of the sales order entry and order processing of the web-based computer sales organization, which replace the manual existing system of the Via-Web Computer Company Limited. The placement of the web-based computerized system is expected to efficiently provide high quality information for the organization. The project will cover major parts of the Sales Order Entry and Order Processing System, which includes the following areas:

- (1) Customer Profile Information.
  - (a) Customer Access
- (2) Product.
  - (a) Product Profile
- (3) Manufacturer.
  - (a) Manufacturer Profile
- (4) Sales Order Entry.
  - (a) Price Order
  - (b) Check Credit
  - (c) Check Goods Availability
- (5) Sales Order Processing.
  - (a) Prepare Delivery Order
  - (b) Prepare Invoice
  - (c) Update Customer Account



## 1.4 Deliverables

- (1) Project Introduction
  - (a) Background of the project
  - (b) Objectives
  - (c) Scope
  - (d) Deliverables
  - (e) Project plan
- (2) Description of the existing system
  - (a) Background and organization functions
  - (b) Existing business functions
  - (c) Current incurred problems and area for improvements
  - (d) Existing manual system
- (3) Description of the proposed new system
  - (a) User requirements
  - (b) System specification
  - (c) System Analysis
  - (d) System design
  - (e) Feasibility Analysis of candidate solutions
  - (f) Hardware and software requirement
  - (g) Network configuration
  - (h) Security and controls
  - (i) System cost and benefits analysis
- (4) Project Implementation
  - (a) Overview of project implementation
  - (b) Test plan and results

- (c) Training and Conversion
- (5) Conclusion and Recommendations
- (6) Entity Relationship Diagram
- (7) Data Flow Diagram
- (8) Feasibility Analysis
- (9) Structure Design
- (10) Process Specification
- (11) Data Dictionary
- (12) Database Design
- (13) Sample Data
- (14) Web Interface Design
- (15) Report Design

## **1.5 Project Plan**

The project plan is represented in Figure 1.1

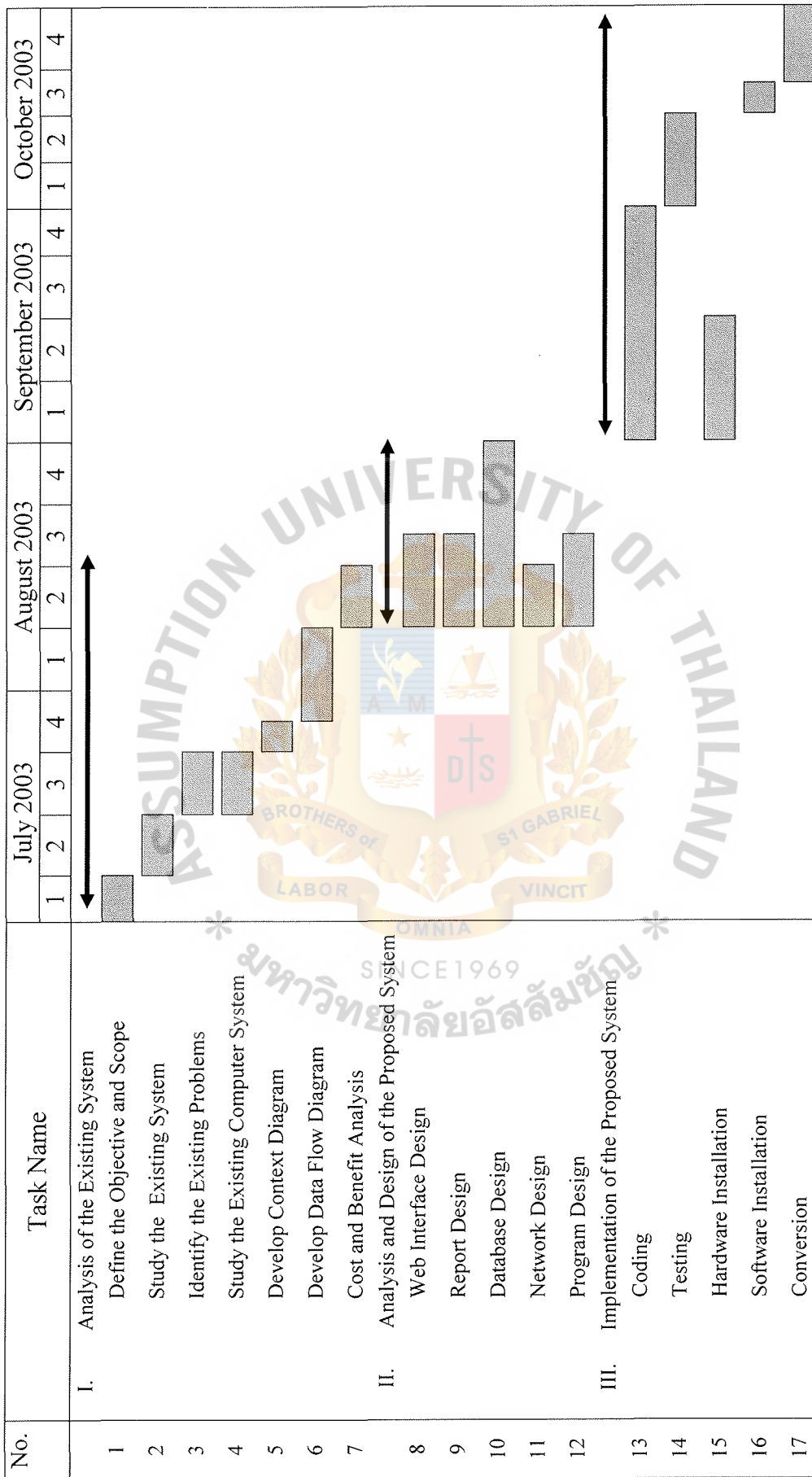


Figure 1.1. Project Plan of Via-Web Computer Company Limited Sales Order Entry and Order Processing System.

## II. THE EXISTING SYSTEM

### 2.1 Background of the Organization

Via-Web Computer Company Limited. is a web-based computer sales organization. They sell many computer products under various product lines, for example, desktops, workstations and servers, notebooks, storages, software, add-ons, etc. The company has a small storefront located in Pantip Plaza on Petchburi Rd., and has been in business for only one year. The organization chart is shown in Figure 2.1.

The company has identified their niche that includes three different types of customers, which are small business, home-office and large business. However, their target customers may change from time to time.

Although the company has been opened for only one year, the amount of works and numbers of services are higher than expected. The workflow in taking order of Via-Web Computer Company Limited can be visualized as follows:

- (1) Customer may need to phone or come into the office to make an order or place a purchase order. The sales representative from sales and marketing department takes the customers details and the product details, for example, a set of computer or any other of the computer parts. These details are recorded on an order form; each order form is assigned a unique number to identify each order.
- (2) The sales representative uses the list of available product to check customer orders, to see if there is an available product required by the customers. If there is an order item available, then, a provisional agreement is made and the customer details are passed on to the sales and marketing department.



- (3) The customers are required to pay deposits in order to confirm their orders. A copy of the completed order is recorded in the diary. The order details are used to produce an invoice. A copy is sent to the customer and another is retained for reference
- (4) The merchandising department sends an invoice and the product to the sales and marketing department. Payments are sent to the finance and accounting department after complete payments has been received from the customer. Payments received from customers are checked against invoice and are recorded on the customer card. A receipt is issued; one for the customer, one for filing and the last one for the finance and accounting department. The customer can pay in cash or by a credit card.
- (5) The orders are filled into different sections according to the current status. Those sections are:
- (a) Initial inquiries
  - (b) Confirmed order
  - (c) Order which product has not been finished \*
  - (d) Order which balance has not been paid
- Only one of the above sections is selected or checked to identify the current status. Some necessary actions will be taken upon the current status, for example, send the reminder or telephone the customer to see if he still requires the desired product or set of computer.
- (6) Products or the finished set of computers are delivered to the customer only when full payment has been made. When products or finished set of computers are posted or collected by the customer, the data is recorded on the customer card. Whenever the information is sent to a customer, for

example, reminder or invoice, a copy of the document is attached to the customer card for further reference.

- (7) If the customer wants to cancel the order, he must notify the company in writing. To get full refund, notice of cancellation must reach the sales and marketing department one week after the order date. Customer can change the order details only before the product, which is the computer, is assembled.
- (8) When an order is made, the sales representative offers the customer a guarantee. To obtain guarantee policy, the sales contracts are passed on the customer's details.
- (9) All the details about order, customer and payment are kept in one card. Once, the customer has taken the product, the customer details are kept in the separate section for a period of time up to ten years, in case there should be any problem at a later date.

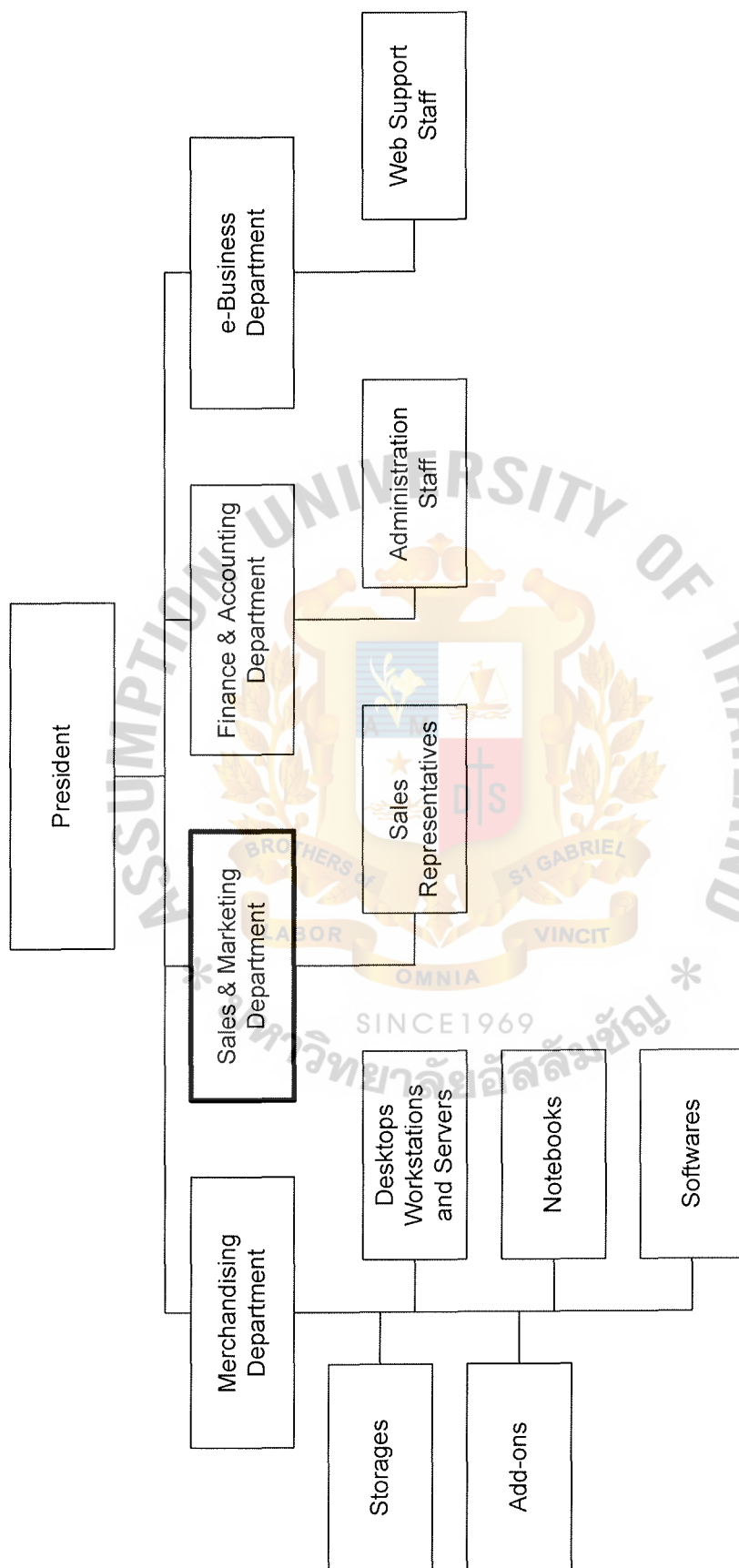


Figure 2.1. Organization Chart of Via-Web Computer Company Limited.

## 2.2 Existing Business Functions

Figure 2.1 illustrates the organization structure of Via-Web Computer Company Limited. There are four departments and one top management in a Top-Down hierarchy, which is described as follows:

### (1) Merchandising Department

Merchandising department includes all developments of merchandising strategies, researches and analyzes new computer products, researches and analyzes competitors, directs new and existing product development, manufacturer relationships management, tracks all computer market trends and pricing, and maintains product management and quality assurance.

This department is, also, mainly responsible for all inventory management, production planning, material requirements planning, producing the company catalog. Moreover, this department has to deal with assembling the products and work closely with Sales and Marketing department, and e-Business department.

### (2) Sales and Marketing Department

Sales and Marketing department includes all order processing, pricing, shipping, billing, sales management, and sales reporting. The department has to deal with identifying customer, making customers aware of the product, and selling the products.

This department is mainly responsible for the advertising and promotional campaigns, and determining prices for products and services. They analyze sales performance and the performance of the sales representatives. Moreover, they conduct the market research and marketing



analysis workstations. Finally, they also take responsibility for locating and contracting prospective customers, tracking sales, processing orders, and providing customer service support.

The sales team actively markets the products to businesses. Each member of the team has to provide phone, mail, and Internet support to clients. Moreover, each member of the team has to provide customer feedback and new product ideas to the Merchandising department, and maintain current knowledge of the marketplace, trends and offerings of major competitors.

### (3) Finance and Accounting Department

Finance and Accounting department encompasses all financial operations of the company, including accounts payable/receivable, customer credit analysis and collection, freight carrier payment and analysis, and payroll processing and distribution. This department takes care of everything from processing manufacturer invoices to setting year-to-year financial goals. The Finance and Accounting department is broken into three sub-departments: accounting, credit and collections, and financial analysis.

Accounting sub-department produces month-end financial reports, maintains audits and reconciles the books, and records of the company, prepares tax returns, and ensures company compliance with all government regulations, processes payroll and handles all employee benefits issues, and processes all accounts payable invoices.

Credit and Collections sub-department develops appropriate credit lines for customers, calls customers on past-due invoices, applies payment

from customers to invoices and minimizes the company's exposure to losses from bad debt write-offs.

Financial Analysis sub-department prepares the annual budget, analyzes competitive threats, budgets and forecasts trends, sets goals to determine strategic direction, performs operational and financial audits, and identifies opportunities for improving efficiencies, reducing costs and maximizing revenues.

(4) e-Business Department

e-Business Department has to deal with the providing of information, for example, history, policies, products and services, and job opportunities, to visitors of the company's web site, and, offering to transact or facilitate the selling of computer products and services online by managing the corporate website and on-line product catalog.

This department is mainly responsible for setting up a web site to inform and promote the computer products and services. The department also creates and maintains Intranets to facilitate the company staffs communicating with one another and to facilitate downloading and uploading information to and from the company's computer, and, sets up Extranet with major suppliers, vendors, manufacturers, and distributors to facilitate information exchange, orders, transactions, and payments. Moreover, the department has to oversee all facets of marketing and development for the Internet.

This department has to ensure the company networks and servers stay online 99.9% of the time and have a quick response times. Moreover, the

department has to ensure the backup and recovery network and servers are up to date.

(5) President

This is the strategic level that monitors sales activity and buying trends affecting new computer products and sales opportunities. The president needs information support planning for new computer products and services, and monitors the performance of competitors. President also supervises and controls all major operations of the company, for example, making both short-term and long-term planning, budget controlling and decision-making. All actions need adequate data to support.

### **2.3 Current incurred Problems and Areas for Improvements**

During the analysis of the existing system, the problems found can be listed as follows: Identifications of these problems are using the PIECES problem-solving framework which is the framework developed by James Wetherbe for classifying the problems.

#### **2.3.1 Current incurred Problems**

(1) Performance

(a) Response time

Order response time as measured from time of order receipt to time of customer delivery has increased to an average of 15 days.

(b) Processing time

Details about customers, agreements and orders are all stored in one form; therefore, it is very difficult and takes time to understand all the information.

(c) Throughput

The recent acquisitions of the new customers will stress the throughput requirements for the current system.

(2) Information and Data

(a) Outputs

Concurrency problems arise where updates to a data item are required.

(b) Inputs

Detail orders are recorded in diary manually by different staffs, therefore errors are common.

(c) Stored data

There currently exists a data inconsistency in the customer and order databases. Sometimes, data of customers and orders is stored redundantly in multiple databases, and there is no standardizing of recording those data.

\* If an order form is mislaid, all the information about the customer and the order details will be lost and cannot be recovered. Moreover, there are no recovery deals with the establishment of correct and consistent states to the database in the event of system or transaction failure.

(3) Economics (Control costs and Increase profits)

(a) Cost

There is a lot of overtime cost because transactions cannot be completed during normal business hours. Moreover, there is a large

amount of paper usage because most of the business process has to be done manually.

(4) Control and Security

(a) Too little security

There is a lack of database security comprises a set of measures, policies and mechanism to provide security, integrity and availability of data to combat possible misuse and loss. Moreover, there is an opportunity to open a web-based order entry system to the Internet, but security and control is an issue.

(b) Too much control

There is a general lack of access to top management and decision-making information. This will be eliminated by the new web-based order processing system.

(5) Efficiency of people and processes

There are people and computers wasting time as data is redundantly input or copied, the data is redundantly processed and the information is redundantly generated.

There is a large volume of paperwork generated for each customer, therefore extensive storage facility is required to store all the paperwork.

(6) Services to customers, suppliers and partners

Major customer satisfactions are beyond the current scope, as customers do not want to spend much time to make orders. Moreover, it is difficult to deal efficiently with inquiries from customers regarding requests and, product and service availability.



The current order entry system is incompatible with the forthcoming web-based order entry system being developed for the suppliers.

### 2.3.2 Areas of Improvement

The improvement must be made to achieve a better response in every way. All departments need to improve in order to attain the goal of efficiency as well as effectiveness.

#### (1) Performance

- (a) Usage of the web-based computerized system to improve the workloads, so that all transactions can be done correctly and immediately.
- (b) Enhance workflow and increase response time by accessing the database directly for monitoring process. If there is any problem, the company staffs can check for the errors and respond immediately.

#### (2) Information and Data

- (a) Eliminate manual data entry by designing the standard data entry format. This format should be easy to use and understand by all of the company staffs, which will help better communication among all departments. With this same format, it is easy to store, retrieve, and produce the report under the same platform.
- (b) Use computer network with the computerized system to link and retrieve the database from SQL Database Server.
- (c) Finance and Accounting Department can retrieve the data, print the summary reports and mark for the further transactions that will be sent back to the system.

#### (3) Economics (Control costs and Increase profits)

- (a) There is an opportunity to reduce the amount of paper and other office supplies usages.
- (4) Control and Security
  - (a) Provide both routine transaction and MIS reports for users. The report will be used for daily operations and for decision making purpose. This will reduce the time for preparing report manually and repetitively in case of submitting to other department. The users can also retrieve all the data from the system immediately and accurately.
- (5) Efficiency of people and processes
  - (a) Set up training for all the staffs to understand the whole system.
  - (b) Introducing the computerized system with the computer network.
  - (c) There is an opportunity not only to provide accurate and efficient workload, but to provide best service to the customers and to fulfill the customers' satisfactions, as well.
- (6) Services to customers, suppliers and partners
  - (a) After the new system is developed, it will provide the suppliers and partners with easy to use reporting tools.
  - (b) There is an opportunity to open order entry and order processing systems to the Internet, so the customers can make an order online with the web-based application newly developed.

## **2.4 Existing Manual System**

There was only one PC computer in the company, as the customer and manufacturer base was quite small; the staffs handled most of the business process manually. This computer was used for the purpose of helping the staffs to generate the reports from the manual records, using Microsoft Word and Microsoft Excel. This

computer is connected to the internet via modem to browse the web and check the mail, and there is no networking provided for the computer.

Now the company wishes to computerize the order entry and order processing system, to make the process faster and error-free.



### III. THE PROPOSED SYSTEM

The objective of the proposed computerized system is to solve the current problems in the existing system. The existing manual system is studied and analyzed, so that the critical problems are found in the ordering system. This proposed computerized system is intended to provide more benefits over the manual system for both operational level and management level.

#### 3.1 User Requirements

The user requirements for the proposed system are the information system specifications. According to the previous chapter, Via-Web Computer Company Limited now requires an effective Sales Order Entry and Order Processing System, which can facilitate the various processes of the sales department, and solve the problems occurring from the existing manual system and some ineffective computerized information system.

In order to achieve the target, the new proposed Sales Order Entry and Order Processing System should have the following components: \*

- (1) Customer Database designed and developed using the high performance database server available to replace the existing manual system for the sales and marketing staffs, some other financial staffs and top management to online, manage the data and make a query.
- (2) Customer Status Database replacing the existing manual system to facilitate the sales and marketing staffs, to systematically keep track of customer contact, and solve the problems occurring from the current system.

- (3) Product Database developed to help the sales and marketing staffs design a practical possible solution with present IT products information, including their available suppliers and prices, in the current IT market.
- (4) Manufacturer Database developed to facilitate the merchandising staffs to systematically keep track of manufacturer contact, and maintain the manufacturer relationships.

### **3.2 System Specification**

To develop the proposed computerized system to manage order entry and order processing of the company's business, the system should be able to handle the purchase and sales management functions of the client. It should be able to maintain information about computer manufacturer, customer, customer order, shipments, shipping cost, and computer product items in stock, then, generate appropriate reports.

The proposed system should maintain details of each computer manufacturer, computer product item and customer order directly from the web-based system. It should be able to accept customer orders from the company web site; moreover, it should be able to keep track of customer orders, generate the bill, and, update the inventory records. The system should generate and display details of customer order and inventory in an easily readable form.

The major inputs of this proposed system are manufacturer details, computer product item details, customer details, and customer orders.

The functionalities that are essential in the proposed system are:

- (1) The system should maintain details of manufacturer, product and customer.
- (2) The system should maintain a history of all customer orders.
- (3) The system should assign a rating to each customer according to his purchase history.



- (4) The system should allow user to generate a list of all customers listed by rating.
- (5) The system should have a user-friendly customer order entry system.
- (6) The system should generate a bill for each customer order.
- (7) The system should allow user to update the shipping date for the customer orders.
- (8) The system should allow user to generate a list of all customer orders that have not been shipped.
- (9) The system should maintain a history of all manufacturer orders and their status.
- (10) The system should allow user to generate a list of all items and their associated manufacturers.
- (11) The system should update the stock for each item after the customer order is shipped.
- (12) The system should allow user to generate a list of all items and their stock quantity, sold quantity and available quantity.

The reports, that the proposed system should be able to generated, are:

- (1) List customers by rating.
- (2) List all product items and their associated manufacturers.
- (3) List all product items and their stock quantity.
- (4) List all customer orders that have not been shipped yet.
- (5) Generate bill for a customer order.

The desirable functionalities of the system are:

- (1) Generate list of items to order from manufacturer based on minimum inventory levels.

- (2) List product items by sale volume.
- (3) The system should be able to computerize payments through credit cards, using the payment gateway provided by local and international bank.
- (4) The system should be able to maintain a history of demand for product items, which are not offered, so that the management can judge the viability of stocking a particular product item.

### **3.3 System Analysis**

The system is designed to be used by the sales force and office staff. The client has a customer base of around 1,000 customers and prospective customers who visit the web site daily.

- (1) Via-Web Computer Company Limited conducted a survey and found that each of the different customer types has a set of specific product line preferences. When customer enter the web site to browse the product, they have to choose the category they belong to and they are shown only the products preferred by that customer type.
- (2) Each of the products sold by Via-Web Computer Company Limited has product code, product name, specifications, features, manufacturer, current price and product image.
- (3) Before placing an order, a first-time customer needs to fill in the profile information. However, an existing customer may use the customer number along with the password and directly place an order.
- (4) The profile information of a customer includes name, address, shipping address, phone, e-mail address, credit card number, credit card bank, expiration date and the name printed on the credit card.

- (5) The first-time customer is required to choose a password, then, a customer number is automatically generated for that customer.
- (6) Each order can contain one or more order line. Each order line corresponds to a product sold by Via-Web Computer Company Limited and no order line can exist without having an order.
- (7) The customer should specify the quantity for each order line. A product may be made of several other parts. Each part is also a product.
- (8) Customers can place order for any product or group of products. For example, a customer could potentially order motherboard, monitor, modem, etc. separately or could order a Compaq Presario S5000NX, the latest hot selling Internet PC, which includes pre-specified components.
- (9) Each order has an order number, date, total amount, payment type, delivery number and special instructions. Each order line has a status, processing date, delivery date, internal shipment number and comment associated with it.
- (10) The status associated with each order line can be backordered (B), picked (P), shipped (S) or cancelled (C).
- (11) Different customer types are given specific payment options. For example, for large/small business, payment options may include business lease, line of credit and credit card.
- (12) Similarly, home-office payment options may include credit card and personal lease.
- (13) A customer who has already got a customer number can access the profile and order status information by providing the customer number and password.

- (14) The customer can change password, review and modify profile, and check the status of order.
- (15) The customer can cancel an order line only if the status for that line is backordered (B) or picked (P); on cancellation, the order line status becomes cancelled (C).
- (16) The system automatically collects the IP address corresponding to each access by customers and also stores a time-stamp associated with that access.
- (17) Via-Web Computer Company Limited top management would like to stay close to their customer and so they often like reports about the customer categories that most often order through the web site and the most popular time of access.
- (18) Periodically, the top management also wants to know what products are the hot selling products in each of the product lines.

### 3.3.1 Data Modeling

The data modeling, which is represented by an entity relationship diagram (ERD), is used in designing the system to develop the database. The entity relationship diagram shows how the information has been stored in the system after it is processed. The new proposed information system focuses on the efficient storage, retrieving and update data, so the relational database is used. Thus, the entity relationship diagram will represent the logical structure of the database in a pictorial manner.

The entity relationship diagram, which is used in designing the proposed system, can be classified into:

- (1) Context data model

Context data model is the data model without key and attribute. It is used primarily to refine the system scope. Many relationships may be nonspecific relationships.

(2) Key base data model

Key based data model is the data model with primary and alternate keys. This model adds associative entities, precise cardinalities and generalization hierarchies, and eliminates nonspecific relationship.

(3) Fully attributed data model

Fully attributed data model is the data model with all keys, attributes, and sub-setting criteria.

The data model will finally be implemented as the database (see Appendix A. for all of the data models). Figure 3.1. shows the context data model of the proposed system.



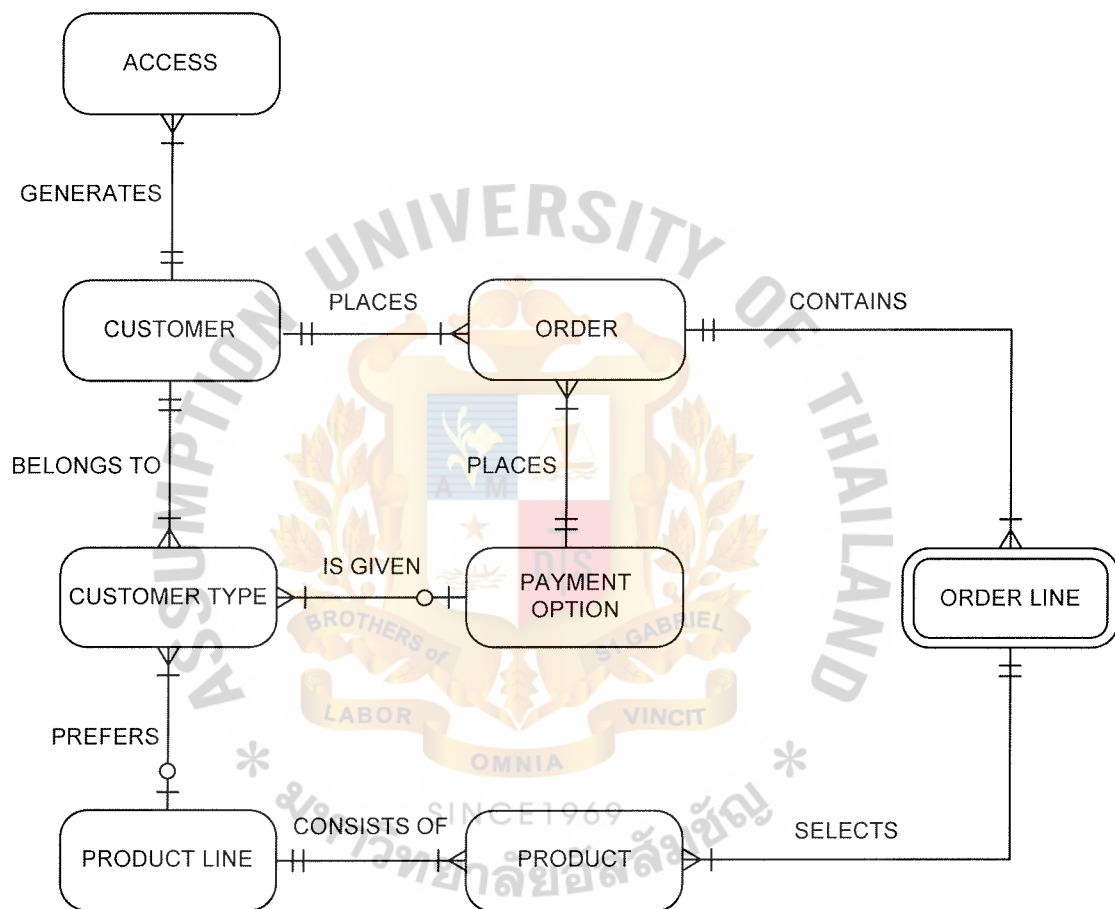


Figure 3.1. Context Data Model of the Proposed System.

### 3.3.2 Process Modeling

Process modeling involves graphically representing of the functions or processes, which capture, manipulate, store, and distribute the data between a system and its environment, and between the components within a system. A common form of process modeling is a dataflow diagram (DFD). It is a modeling tool, which shows the source and destination of the data. It identifies and names the process performs, and identifies data stores accessed by processes of the proposed system.

The most basic level of dataflow diagram is context dataflow diagram. It is drawn to establish initial project's scopes. Context data flow diagram of proposed system is illustrated in figure 3.2.



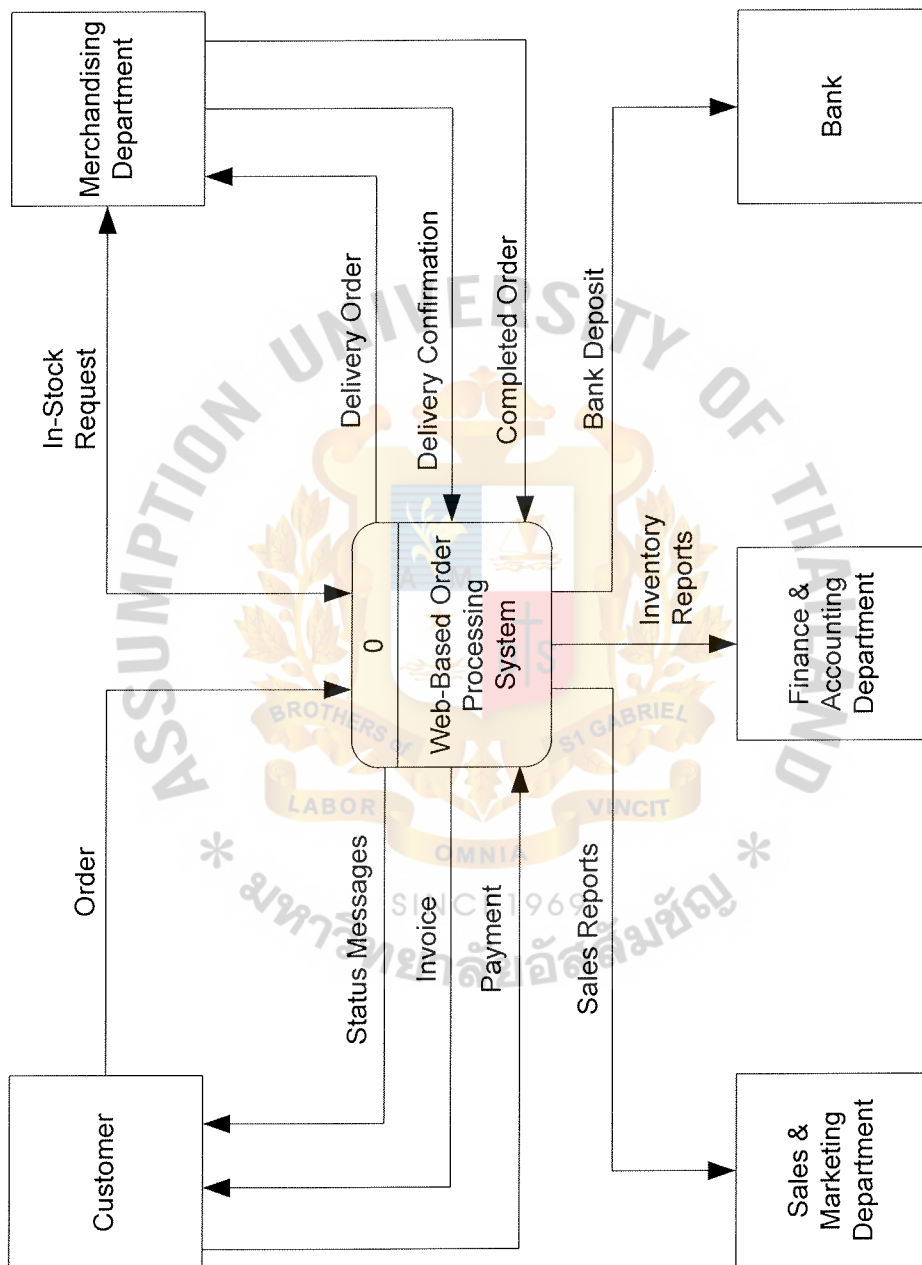


Figure 3.2. Context Data Flow Diagram of the Proposed System.

From the dataflow diagram shown in Figure 3.2., there are five external agents. Those external agents or external entities are the agents or the entities that interact with the system by providing the net input to the system and receive the net output from the system. They are considered as external to the system being analyzed or designed, which means that they are outside the project's scopes.

There are only five external agents in the dataflow diagram because the proposed information system involves and has an affect on all departments in the company. All departments can be considered internal to the system.

(1) Customer

Customer, who is a first time customer, needs to provide the profile information to the system. However, an existing customer may use the customer number along with the password and directly place an order. The profile information of a customer includes name, address, shipping address, phone, e-mail address, credit card number, credit card bank, expiration date and the name printed on the credit card. The first time customer needs to choose a password, then, a customer number is automatically generated for that customer.

(2) Merchandising Department

Merchandising department provides the product information to the system. When a customer places order on the company's web site, the system checks if the products items are available in stock. Then, the system issues a status message to the customer, and generates a delivery order to the Merchandising department, which fills the order. The completed order information is used to create an invoice for the customer. The delivery

confirmation from the Merchandising department will be used to manage the account receivable.

(3) Sales and Marketing Department

Sales and Marketing department provides the market information to the system, and receive sales report from the system. Normally, various reports produced by the system are required by this department. For example, when the order is shipped, and the customer is billed, then the system produces the reports. Those reports are sent to Sales and Marketing department.

(4) Finance and Accounting Department

Finance and Accounting department provides the finance and accounting information to the system. The department can be considered as an external agent of the system; even it is the user of the system. Finance and Accounting department, usually, generates bills for financial and accounting purposes. Some invoices are sent to the department for later payment. Most of the inventory reports are to sent to the Finance and Accounting department.

(5) Bank

Bank can be considered as an external agent to the system. Daily payments from the customers will be recorded to the system. Normally, those payment details will be recorded to the Accounts Receivable database. Finally, the system will generate a bank deposit, from the Accounts Receivable database, for the company's staff to deposit the amount collected to the bank.



The proposed information system is considered as a complex system because it involves all the company activities. Those are the activities from the Merchandising department, Sales and Marketing department, Finance and Accounting department, and from the bank. Therefore, the decomposition diagram is needed to break a system into its component sub-system, process, and sub-process to make it easier to understand. A complex system is usually too difficult to fully understand when it is viewed as a whole or single process.

The decomposition diagram can be treated as a planning tool before drawing a detailed process model or a data flow diagram. Decomposition diagram is illustrated in figure 3.3. There are altogether seven processes in the proposed system, which will be discussed in detail next.



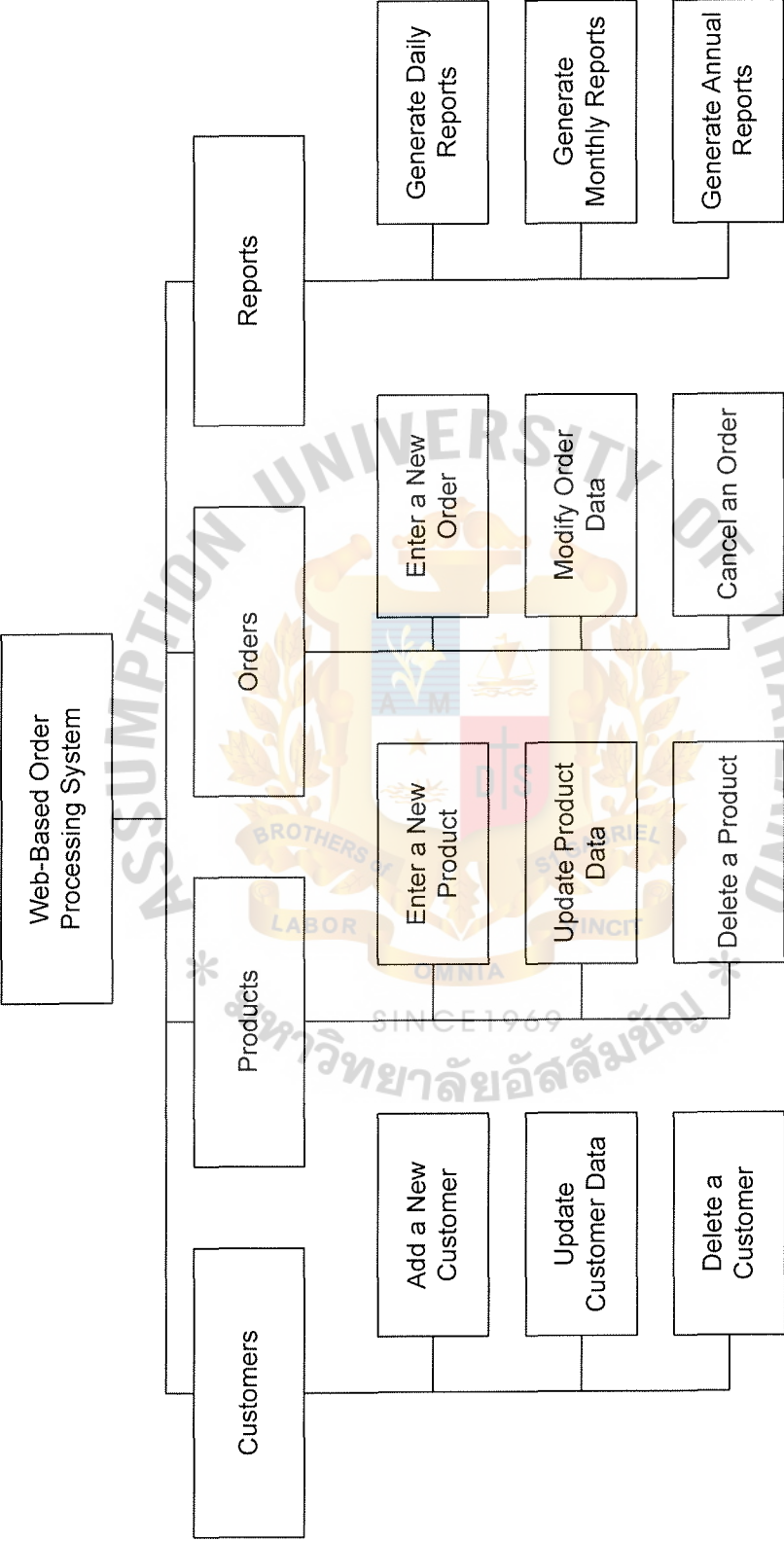


Figure 3.3. Decomposition Diagram of the Proposed System.

(1) Check Status

This process starts when the customer fills the order online, the system will check the status of the customer if the customer is the first-time customer. The registration is needed for the first-time customer. Using the given password from the system, the existing customer can log in to make an order online. Moreover, the system will check the credit status of the particular customer. Finally, the system will check the availability of the product ordered. All the information will be recorded in the pending orders database.

(2) Issue Messages

This process aims to issue messages to inform the customer if the customer's request has been fulfilled. Those messages include the completion of the registration for the first-time customer, the password generated by the system for the customers, the acceptance or rejection of an order.

(3) Create Invoice

This process starts when the merchandising department sends the completed order information to the system. The customer information along with the products information is used to create the invoice. Then, the invoice is sent to the customer. The invoice data is recorded in the account receivable database.

(4) Generate Delivery Order

The order data, which is kept in the pending order database, is used in this process. The purpose of this process is to generate the delivery order for the merchandising department.

(5) Apply Payment

When the system receives the invoice data together with the payment information from the customer, this process starts. The payment details will be recorded to account receivable database.

(6) Produce Reports

This function is a very important function as various reports need to be produced from time to time. The reports will be generated by the system on the following basis: daily, monthly, and annually. The system generates the report outputs both on screen and print-out to the printer.

(7) Manage Accounts Receivable

This process aims to generate the bill for money collection at the end of the month. The system uses the purchasing information of previous fourth month according to credit terms to issue the bill for the customer. The list of invoices in the bill is checked against the master copy of invoice from the finance and accounting department. The bill along with the master copy of invoice is submitted to customer for verification before payment.

Data flow diagram level 0, which shows all processes in the system or big picture on the system. And, Data flow diagram level 1, which shows the detail on each process in the data flow diagram level 0. Both data flow diagram level 0 and data flow diagram level 1 are shown in the Appendix B.

### 3.4 System Design

System design is the problem solving technique that is complementary to the system analysis. In system design, we reassemble the system's component pieces back into a complete system with the hope of an improved system.

The system design may involve adding, deleting, and changing pieces relative to the original system. The techniques used in system design will be discussed separately below.

#### (1) Structure Design

Structure design or top-down program design is a process-oriented technique to break the large program into an hierarchy of modules that result in the computer program. The computer program will be easier to implement and maintain.

The model derived from structure design is a structure chart which is typically used in conjunction with data flow diagram, namely dataflow diagram models the system and the structure chart models the software, coded and tested to support the system.

The structure chart represents an hierarchy of software program modules including documentation of interfaces between the modules. The structure chart acts not only as the design blueprint for the software coding but as a guide to software testing, as well. It guides the coding of modules, the order in which the modules will be built and tested, and the assignment of codes to specific modules. It also serves as external documentation for software maintenance later or after the system has been implemented. All of the structure charts are illustrated in Appendix D.

#### (2) Process Specification

Process Specification provides the detail on each process in the data flow diagram. It specifies the data flown into and from the process, steps performed in each process to transform input into output, external agent related to the process, and data stores in which the process create, delete, update, retrieve information to and from respectively. For process specification, see Appendix E.

(3) Data Dictionary

Data dictionary is the repository of all data definition for all tables in the database. The purpose of data dictionary is to define and catalog all data element for future reference. For more details of the data dictionary, see Appendix F.

(4) Database Design

Database schema is a physical model or blueprint for a database. It represents the technical implementation of the logical data model, which is employed in database design.

Database schema specifies detail of each attribute in the table based on capabilities, terminology, and constraints of the chosen database management system (DBMS). In the proposed computerized information system, the MySQL database is used as the database management system.

Each database management system supports different data type, integrity rule, and so. The details, which must be specified for each attribute in the table, include the data type, field size, uniqueness, nullity, and so. All of the database designs are shown in Appendix G.

(5) Web Interface Design



In order to have the data in the database, the input of the data is required. Input can be classified into two characteristics. First, how the data is initially captured, entered and process. Second, the method and technology used to capture and enter the data.

Data can be captured in the paper form before entering to the database, for example, the price list from the supplier. Data can also be entered directly into the database without data capture process. For example, the customer can make an online order entry directly from the web site.

The proposed computerized information system is a web-based application. The user of the application includes all of the departments in the company, the customers, and all of the suppliers who visit the web site. The data can be entered to the database via the web interface of the application. All of the web interface designs are shown in Appendix I.

#### (6) Output Design

Output can be considered as the most visible component of the working information system. It can be classified into two characteristics. First, it is the distribution and audience of output, which involves the distribution of output inside or outside of the company and the people who read and use of the output. Second, it is the implementation method for the output. The output can be the printed output, the screen output, the point of sale terminal, the multimedia presentation, E-mail, hypertext, and microfilm.

There are two kinds of outputs which are internal outputs and external outputs. The internal outputs are intended for people or department within

the company. They include various reports for the management and for all of the departments in the company. For the management, the internal outputs are used for the decision making, while the Finance and Accounting department uses those internal outputs for financial and accounting purposes. Moreover, for Sales and Marketing department uses those internal outputs for sales prediction and marketing planning.

The external outputs, which leave the company to the external agents, are various documents in the transaction. For example, customer order, customer invoice, and billing note.

Finally, various kinds of report, which are implemented on the screen, can be printed out. For more detailed designs of the reports see Appendix J.

### **3.5 Feasibility Analysis of Candidate Solutions**

From the business requirements listed in the previous section, there are many candidate solutions to fulfill those requirements. Candidate systems matrix is used to effectively capture, organize, and compare those candidate solutions. The analysis will be done on the predefined characteristics, for example, portion of system computerized, business benefit, server and workstation, software tools, application software, method of data processing, output device and implication, input device and implication, and storage device and implication.

Based on the business requirements of the proposed system, the industry-specific software often provides the best business process solutions for the smaller companies. However, the solution is changing fast, while most of the industry-specific solutions do not have the extensive online web-based order entry and order processing functions. The software, which is being used, may already have the online web-based functionality added in the last update.

Currently, there is no online web-based order entry and order processing package offers all of the major functions associated with the various categories. Therefore, there are two in-house development candidates, that are using the different platforms and the development tools.

### Candidate Systems Matrix

The candidate systems matrix documents similarities and differences between the candidate systems.

#### (1) Candidate 1

Candidate 1 represents the purchase of the available package software. Using the available package software can reduce the development time with low risks but it is high cost relative to the other two candidates.

#### (2) Candidate 2

Candidate 2 is an in-house software development company using PHP web programming language with MySQL database server which is operated on Apache web server. This candidate develops all of the application software on Linux-Knoppix 3.3 operating system.

#### (3) Candidate 3

Candidate 3 proposes an in-house development of comparable software using Windows ASP.NET programming language on Microsoft .NET framework with Oracle 9i database Server. This candidate develops all of the application software on Microsoft Windows 2003, using Internet Information Services (IIS) as a web server.

Table 3.1. Candidate Systems Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of System Computerized	COTS package A-Cart Gold from Quantum Corp. would be purchased to satisfy web-based online required functionality.	Management report, information collection, customer order, financial and inventory control.	Same as candidate 2.
Benefits	This solution can be implemented quickly because it is a purchased solution.	Fully support user required business processes for Via-Web Co., Ltd. Plus more efficient interaction with the bank payment gateway.	Same as candidate 2.
Servers and Workstations	Intel XEON 3.2 GHz Dual Processors for server, and Intel Pentium IV 2.8 GHz for workstations (clients).	Same as candidate 1.	Same as candidate 1.
Software Tools Needed to Design and Developed	None.	Linux-Knoppix 3.3 GNOME & KDE Apache HTTP server 2.0.48 PHP 4.3 MySQL 4.1	MS Windows 2003 MS ASP.NET and MS .NET framework. Oracle 9i
Application Software	Package Solution.	Custom Solution.	Same as candidate 2.
Method of Data Processing	Client/Server	Same as candidate 1.	Same as candidate 1.
Output Devices and Implications	Laser Printer and 24 Pin Dot-Matrix Printer.	Same as candidate 1.	Same as candidate 1.
Input Devices and Implications	Keyboard and mouse	Same as candidate 1.	Same as candidate 1.
Storage Devices and Implications	Hard disk of 250 GB	MySQL 4.1 with storage capacity of 250 GB	MS SQL Server 7 with storage capacity of 250 GB

After completion of candidate systems matrix, each candidate solution must be analyzed for feasibility by using feasibility analysis matrix, which is the way to evaluate each solution independently against four criteria: operational feasibility, technical feasibility, economic feasibility, and schedule feasibility. Each criterion on each candidate solution is given with the score that will be multiplied by predetermined weight rate. The final score for each candidate solution will eventually derive from additional of all score after multiplication. Feasibility analysis matrix is shown in Table 3.2.



Table 3.2. Feasibility Analysis Matrix.

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Operational Feasibility	30%	Partially support web-based online required functionality. It can generate only the predefined report from the software company. Customization of the package is not allowed.  Score: 60	Fully support user required functionality.  Score: 100	Same as candidate 2.  Score: 100
Technical Feasibility	20%	Current production release of A-Cart Gold package is version 6.2.4 and has only been on the market for 4 weeks. Maturity of product is risk and company charges an additional monthly fee for technical support.  Score: 50	Current programmer has full experience with Web-Based Application; therefore, the development process can be done easily and smoothly. Linux operating system is very stable for the server. PHP and MySQL database server can work well together without any problems, most of the Linux servers use PHP with MySQL database.  Score: 80	Although current technical staff is comfortable with .NET framework, management is concerned with recent acquisition of .NET framework by Microsoft. Oracle 9i is a current company standard and compete with MS SQL Server in the Client/Server DBMS Market. Because of this we have no guarantee future versions of ASP.NET will “play well” with our current Oracle 9i Server.  Score: 60



Table 3.2. Feasibility Analysis Matrix (Continued).

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Economic Feasibility	30%	Approximately Baht 1,373,190. Approximately 1 year 10 months. Approximately Baht 2,473,774. See Appendix C  Score: 85	Approximately Baht 1,069,190. Approximately 2 years 6 months. Approximately Baht 1,126,026. See Appendix C  Score: 95	Approximately Baht 2,282,190. Approximately 3 years. Approximately Baht 1,407,362. See Appendix C  Score: 60
Schedule Feasibility	20%	3 months Score: 95	6 months Score: 95	6 months Score: 95
Ranking	100%	72.5	93.5	79

Candidate 2 is recommended because it gets the highest score among 3 candidate solutions. Candidate 2 uses three-tiered client/server computing architecture. The three-tiered client/server system is a solution in which: (1) the data and data manipulation layers are placed on their own server or servers, (2) the application logic is placed on its own server, and (3) only the presentation logic and the presentation are placed on the client.

### 3.6 Hardware and Software Requirements

The selected candidate solution requires one database server with an application server which is, also, the web server to implement the system as the proposed system is designed to be a web-based system. All the server and client computers are running on the Linux Operating System. There are a lot of software provided by the Linux which can get connected among a normal Intel-based PC Sever, Application Server and Database Server.

The hardware and software specifications for the purposed system are shown in the Tables 3.3. and 3.4. respectively.



Table 3.3. The Hardware Specification for Server.

Hardware	Specification
CPU	Intel XEON 3.2 GHz Dual Processors
Memory	2 GB DDR / PC3200 (4 DIMM)
Hard Drive	250 GB 7200 rpm Ultra DMA
Optical drive	8X DVD + RW / + R drive
Removable storage	3.5 inch 1.44 MB Floppy Diskette
Video/graphics	Integrated Intel Extreme graphics
Audio	Integrated audio
Speaker	Internal speaker
Keyboard	PS/2 standard keyboard
Mouse	PS/2 scroll mouse
Network Adapter	PCI-X Gigabit Network 10/100/1000 (WOL)
Display	17" CRT - Flat Face Plate CRT
Printer	Black & White Laser Printer
UPS	3,000 VA

Table 3.4. The Software Specification for the Server.

Software	Specification
Operating System	Linux – Knoppix 3.3
Desktop Shell	GNOME & KDE
Web Server	Apache HTTP Server 2.0.48
Application Server	PHP 4.3
Database Server	MySQL Database Server 4.1

In the Intranet System, the client computers need to have a capacity only high enough to run a Linux Operating System, a Web Browser like Mozilla Web Browser or Konqueror Web Browser for Linux, and a Mail Application like Mozilla Mail for Linux. However, it should have specifications higher than that as it is, sometimes, used to run any other Office Automation Software, such as Word Processing, Spreadsheet, Presentation, Graphic Drawing, etc. Therefore, the general standard of selecting the hardware, should have the hardware specification high enough to run Knoppix 3.3 Linux Operating System and Open Office 1.1. The hardware and software specification for each client computers are shown in the Table 3.5. and 3.6. respectively.

Table 3.5. The Hardware Specification for Client.

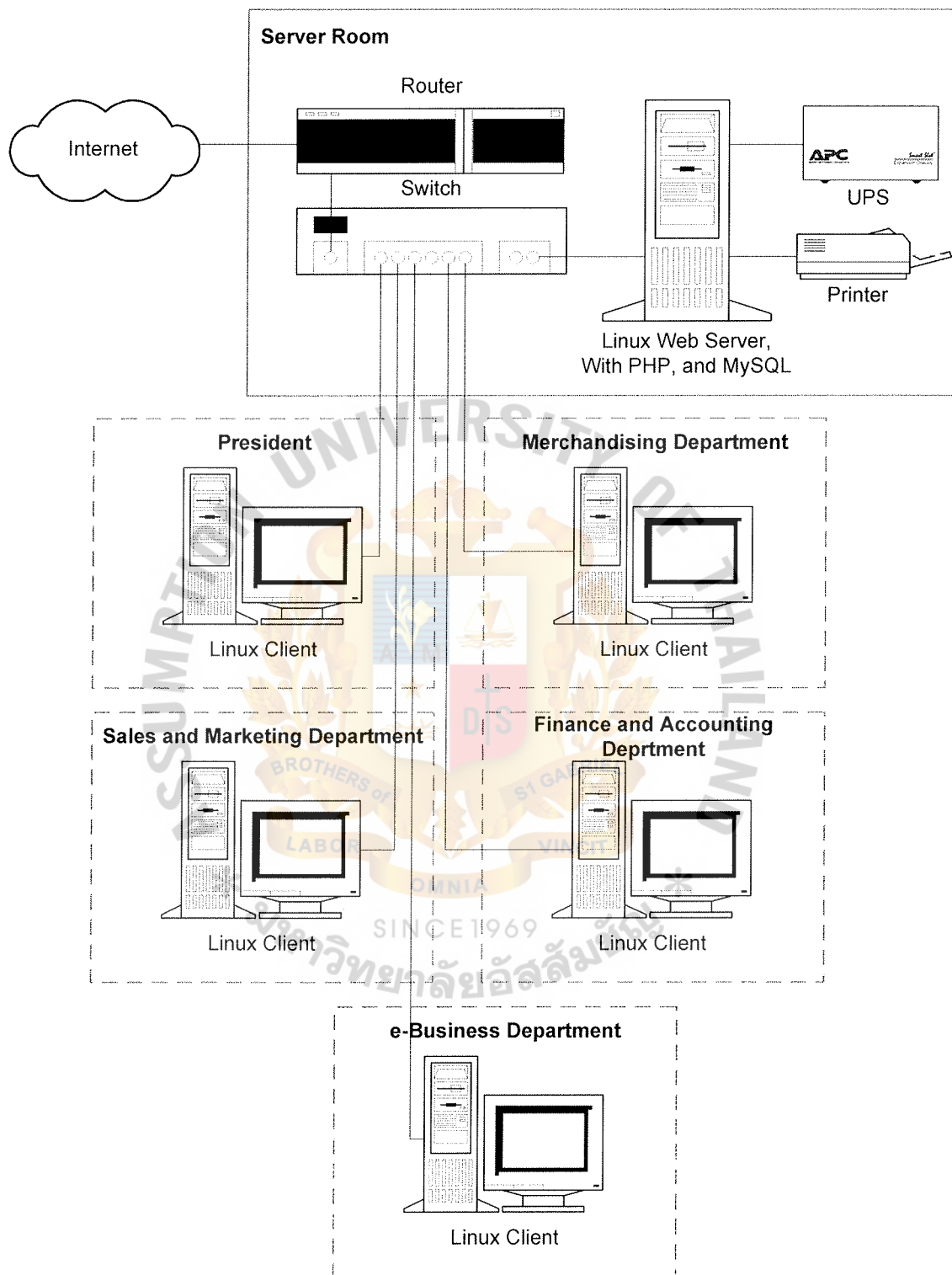
Hardware	Specification
CPU	Intel Pentium IV 2.8 GHz
Chipset	Intel 865B chipset
Memory	1 GB DDR / PC3200 (2 DIMM)
Hard Drive	80 GB 7200 rpm Ultra DMA
Optical drive	48x max CD-Writer (48x24x48x)
Removable storage	3.5 inch 1.44 MB Floppy Diskette
Video/graphics	256 MB DDR NVIDIA GeForce FX
Audio	Sound Blaster Audigy 2
Speaker	Altec-Lansing 251 5.1
Keyboard	PS/2 standard keyboard
Mouse	PS/2 scroll mouse
Network Adapter	Integrated 10/100 Base-T Ethernet
Display	17" LCD flat panel display

Table 3.6. The Software Specification for Client.

Software	Specification
Operating System	Linux – Knoppix 3.3
Desktop Shell	GNOME & KDE
Web Browser	Mozilla 1.5
Email Application	Mozilla Mail
Office Suite	Open Office 1.1

### 3.7 Network Configuration

The connection between the database server and the client computers can be established through the Local Area Network (LAN) which has to be newly set up. The network configuration of the proposed system is shown in Figure 3.4.



Firugre 3.4 Network Configuration of the Proposed System.



From the above network configuration, the network equipment specification of the proposed system is shown on the Table 3.7.

Table 3.7. The Network Equipment Specification for the Proposed System.

Network Equipment	Specification
Network Topology	Star Topology
Network Router	Cisco Router
Network Switch	Cisco Catalyst 2950 24-Port
Network Interface Card	10/100/1000 Base-T Fast Ethernet Card
Wiring and Cable	UTP CAT5e

### 3.8 Security and Controls

To communicate across a network system, the following minimum requirement of security and controls standard must be applied to every computerized system to prevent unauthorized access and alteration to the system.

(1) Identification

Entities within the network system need to be able to identify one another. An identifier usually takes the form of a name or an address, so the system must have the unique User ID and Administrative System ID. The procedure to control the creating of User ID must be set up to ensure the proper verification over the system users.

The user responsibility to the system must be specified in advance before granting authorized level to each user. Every User ID must have an owner, and can prove their existence.

In each department, User ID must not be shared among officers and staffs. Administrative System ID must be carefully assigned to the responsible person for managing all User IDs of the system. System log is required to keep track of all changes made to the system.

## (2) Authentication

The password system is required to authenticate the assigned User. The system or security parameter of password feature must be carefully configured to ensure the password is properly defined and monitored.

Authentication and identification are different. Identification requires that the verifier check the information presented against all the entities it knows about, while authentication requires that the information be checked for a single, previously identified, entity.

In addition, while identification must, by definition, uniquely identify a given entity, authentication does not necessarily require uniqueness.

For instance, someone logging into a shared account is not uniquely identified, but by knowing the shared password, they are authenticated as one of the users of the account. Furthermore, identification does not necessarily authenticate the user for a particular purpose.

The characteristics of good password feature are the specification of minimum range of password, normally between 6 to 8 lengths, non-displaying password on system screen, forces the user to change password automatically when the password is expired in a specified duration, and locks User ID when entering incorrect password more than a specified time.

Users must keep their password secret to prevent unauthorized person to use their password to enter the system and cause the unauthorized alteration to the system.

(3) Authorization

The authorized level of all users must be defined carefully to limit the area of accessing in advance according to the sensitivity of data and software. The data owner is responsible for evaluating the right and responsibility of each user before assigning User IDs. The user authorization should be updated when the users change their responsibility, or are deleted when the users resign. Moreover, these user rights must be revised every 6 months to ensure the appropriate authorization in the system.

(4) Auditing

The system must have an audit trail, which records all transactions done by each user. This audit trail may be in the form of system log. It can be used to monitor the changes to the system and the access violation, and investigate an unauthorized access and alteration in the system. This audit trail must be reviewed by the authorized person on a consistent basis.

(5) Production Environment

The system should be separated into two different areas which are the development area and the production area, when the new application program is being developed. This practice ensures the proper control over the unauthorized modification of the developed program in the production area because any new or modified program must be tested by the system owner in the development area before migrating into the production area.

## (6) Backup and Recovery

Backup and Recovery are very important for the computer system to protect the critical data and application will be safe in case of hard drive failure or virus. Backup may be done on a daily, weekly, or monthly basis according to the schedule. There are many ways of backing up the data and application, and there are many types of media to use, as well.

Recovery process must be clarified to ensure that all relevant persons know how to restore information from backup media.

## (7) Uninterruptible Power Supplies or UPS

In case of electric power outage, UPS will supply the emergency electric power to the system for continuing some processing processes within a short period of time, or saving the unfinished processes and shutting down the system. After the electric power problems have been solved, the system will be started again continuously.

## (8) Virus Protection

As the research stated that 61% of all viral infections are caused by the virus infected diskette, the network system has set up a policy to scan all the diskettes, by the anti-virus application, before using those diskettes with the computer within the network. However, new virus has arisen every day, so the system has to update the virus definitions automatically on a regular basis.

### 3.9 System Cost and Benefits Analysis

The cost of the existing manual system and the proposed computerized system are used to compare and analyze if the proposed system is worth for investment. Furthermore, the benefits of the new system are presented in both tangible and intangible terms. Once, both cost and benefits are analyzed, the analysis techniques are applied to indicate the value for implementing the proposed system. Those techniques, which will be used to present the benefits over the cost after the implementation of the proposed system, are break-even analysis, payback period analysis, and net present value analysis techniques.

#### (1) Cost of Manual System

Since, the existing system is operated manually, there are both fixed cost and annual operating cost. The fixed cost is the initial investment for office equipments. The annual operating cost includes the salary expense, office supplies and miscellaneous expense.

##### (a) Fixed Cost

Fixed cost covers those office equipments that are used by the staffs for their daily operations; for example, file cabinets, ink-jet printers, and calculators. This fixed cost will cost only once as the investment, but in the later year, the maintenance cost must be allocated for repairing them. Table 3.8. shows the fixed cost of the existing manual system.

Table 3.8. Manual System Fixed Cost, Baht.

Fixed Cost			Baht
File Cabinet	4 units	@ 4,500	18,000.00
Ink-jet Printer	2 units	@ 8,000	16,000.00
Calculator	6 units	@ 1,500	9,000.00
Total Fixed Cost			43,000.00

(b) Operating Cost

Operating cost can be divided into salary expense and other expense. Salary expense covers the salaries of all staffs from the president of the company to all the staffs in all departments, such as, merchandising department, sales and marketing department, and finance and accounting department. Other expense covers all expenses of those office supplies and miscellaneous expense; for example, stationary, paper, utility and others. Table 3.9. shows the operating cost of the existing manual system.



Table 3.9. Manual System Operating Cost, Baht.

Operating Cost		Baht
Salary Expense:		
President	1 Person @ 36,000	36,000.00
Staff:		
Merchandiser	2 Persons @ 12,000	24,000.00
Sales	3 Persons @ 13,500	40,500.00
Finance and Accounting	2 persons @ 15,500	31,000.00
Total Monthly Salary Expense		131,500.00
Total Annual Salary Expense		1,578,000.00
Other Expense:		
Stationery	Per Annual	18,000.00
Papers	Per Annual	22,000.00
Utilities Expense	Per Annual	15,000.00
Misc. Expense	Per Annual	10,000.00
Total Other Expense		65,000.00
Total Annual Operating Expense		1,643,000.00

All operating costs, which are salary expense, and office supplies and miscellaneous expense, in the existing manual system, will increase by 10% per annum. The detailed calculation of the existing manual system cost is presented in Table 3.10, and the five years accumulated manual system cost of the existing system is summarized in Table 3.11. respectively.

Table 3.10. Manual System Cost Analysis, Baht.

Cost (Baht)	Year				
	1	2	3	4	5
<u>Fixed Cost</u>					
File Cabinet 4 units @ 4,500	18,000.00				
Ink-jet Printer 2 units @ 8,000	16,000.00				
Calculator 6 units @ 1,500	9,000.00				
Total Fixed Cost	43,000.00				
<u>Operating Cost</u>					
<u>Salary Expense:</u>					
President 1 Person @ 36,000	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
<u>Staff:</u>					
Merchandise 2 Persons @ 12,000	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Sales 3 Persons @ 13,500	40,500.00	44,550.00	49,005.00	53,905.50	59,296.05
Finance and Accounting 2 persons @ 15,500	31,000.00	34,100.00	37,510.00	41,261.00	45,387.10
Total Monthly Salary Expense	131,500.00	144,650.00	159,115.00	175,026.50	192,529.15
Total Annual Salary Expense	1,578,000.00	1,735,800.00	1,909,380.00	2,100,318.00	2,310,349.80
<u>Other Expense:</u>					
Stationery Per Annual	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Papers Per Annual	22,000.00	24,200.00	26,620.00	29,282.00	32,210.20
Utilities Expense Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Misc. Expense Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Other Expense	65,000.00	71,500.00	78,650.00	86,515.00	95,166.50
Total Annual Operating Expense	1,643,000.00	1,807,300.00	1,988,030.00	2,186,833.00	2,405,516.30
Total Manual System Cost	1,686,000.00	1,807,300.00	1,988,030.00	2,186,833.00	2,405,516.30

Table 3.11. Five Years Accumulated Manual System Cost, Baht.

Year	Total Manual Cost	Accumulated Manual Cost
1	1,686,000.00	1,686,000.00
2	1,807,300.00	3,493,300.00
3	1,988,030.00	5,481,330.00
4	2,186,833.00	7,668,163.00
5	2,405,516.30	10,073,679.30
Total	10,073,679.30	-

## (2) Cost of Computerized System

The cost of computerized system is concerned with 2 parts, which are as follows.

### (a) System Development Cost.

The development cost includes all cost of hiring personnel to develop the new information system, acquiring the new hardware and software, and training the existing staffs. Table 3.12. shows the development cost of the proposed system.



Table 3.12. Proposed System Development Cost, Baht.

System Development Cost			Baht
Personnel Cost:			
System Analyst	4 Months	@ 32,000	128,000.00
Programmer	4 Months	@ 28,000	112,000.00
Network Specialist	2 Months	@ 30,000	60,000.00
Total Personnel Cost			300,000.00
Hardware Cost:			
Server	1 Unit	@ 152,690	152,690.00
Workstation	5 Units	@ 69,900	349,500.00
Laser Printer	2 Unit	@ 31,900	63,800.00
UPS 3000VA	1 Unit	@ 28,200	28,200.00
Router	1 Unit	@ 30,000	30,000.00
Switching	1 Unit	@ 25,000	25,000.00
Total Hardware Cost			649,190.00
Installation Cost			50,000.00
Training Cost			70,000.00
Total Development Cost			1,069,190.00

(b) System Operating and Maintenance Cost

The system operating and maintenance cost includes all cost of salary expenses and other expenses. Table 3.13. shows the system operating and maintenance cost of the proposed system.

Table 3.13. Proposed System Operating and Maintenance Cost, Baht.

System Operating and Maintenance Cost		Baht
Salary Expense:		
President	1 Person @ 36,000	36,000.00
Staff:		
Merchandiser	1 Person @ 12,000	12,000.00
Sales	2 Persons @ 13,500	27,000.00
Finance and Accounting	1 person @ 16,000	16,000.00
e-Business	1 person @ 15,000	15,000.00
Total Monthly Salary Expense		106,000.00
Total Annual Salary Expense		1,272,000.00
Other Expense:		
Stationery	Per Annual	14,000.00
Papers	Per Annual	12,000.00
Utilities Expense	Per Annual	15,000.00
Misc. Expense	Per Annual	10,000.00
Total Other Expense		51,000.00
Total System Operating and Maintenance Cost		1,323,000.00

Detailed calculations of each candidate costs are illustrated in Appendix C. Summarized cost of the proposed computerized system is shown in Table 3.14, and the five years accumulated computerized cost of the proposed computerized system is summarized in Table 3.15. respectively.





Table 3.14. Computerized System Cost Analysis, Baht.

Cost (Baht)	Year				
	1	2	3	4	5
<u>System Development Cost:</u>					
<u>Personnel Cost:</u>					
System Analyst 4 Months @ 32,000	128,000.00				
Programmer 4 Months @ 28,000	112,000.00				
Network Specialist 2 Months @ 30,000	60,000.00				
Total Personnel Cost	300,000.00				
<u>Hardware Cost:</u>					
Server 1 Unit @ 152,690	152,690.00				
Workstation 5 Units @ 69,900	349,500.00				
Laser Printer 2 Unit @ 31,900	63,800.00				
UPS 3000VA 1 Unit @ 28,200	28,200.00				
Router 1 Unit @ 30,000	30,000.00				
Switching 1 Unit @ 25,000	25,000.00				
Total Hardware Cost	649,190.00				
Installation Cost	50,000.00				
Training Cost	70,000.00				
Total Development Cost	1,069,190.00				
<u>System Operating and Maintenance Cost:</u>					
<u>Salary Expense:</u>					
President 1 Person @ 36,000	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
<u>Staff:</u>					
Merchandise 1 Person @ 12,000	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Sales 2 Persons @ 13,500	27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Finance and Accounting 1 person @ 16,000	16,000.00	17,600.00	19,360.00	21,296.00	23,425.60
e-Business 1 person @ 15,000	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Monthly Salary Expense	106,000.00	116,600.00	128,260.00	141,086.00	155,194.60
Total Annual Salary Expense	1,272,000.00	1,399,200.00	1,539,120.00	1,693,032.00	1,862,335.20
<u>Other Expense:</u>					
Stationery Per Annual	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Papers Per Annual	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Utilities Expense Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Misc. Expense Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Other Expense	51,000.00	56,100.00	61,710.00	67,881.00	74,669.10
System Maintenance Cost	-	-	-	76,378.50	76,378.50
Total System Operating and Maintenance Cost	1,323,000.00	1,455,300.00	1,600,830.00	1,837,291.50	2,013,382.80
Total Computerized System Cost	2,392,190.00	1,455,300.00	1,600,830.00	1,837,291.50	2,013,382.80

Table 3.15. Five Years Accumulated Computerized Cost, Baht.

Year	Total Computerized Cost	Accumulated Computerized Cost
1	2,392,190.00	2,392,190.00
2	1,455,300.00	3,847,490.00
3	1,600,830.00	5,448,320.00
4	1,837,291.50	7,285,611.50
5	2,013,382.80	9,298,994.30
Total	9,298,994.30	-

(3) The Comparison of the System Costs between Manual System and Computerized System

Once the system cost of both existing and proposed system has been identified, this information can be used to construct the system cost comparison table to evaluate the cost saving from implementing the proposed computerized system. The figures are summarized in the Table 3.16.

Table 3.16. The Comparison of the System Costs, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,686,000.00	2,392,190.00
2	3,487,875.00	3,847,490.00
3	5,469,855.00	5,448,320.00
4	7,650,033.00	7,285,611.50
5	10,048,228.80	9,298,994.30

The above table indicates the accumulated cost of both existing and proposed system. It shows that the existing system has a lower accumulated cost than the proposed system for the first year only. Cost comparison between the existing system and the proposed system is represented in Figure 3.5.

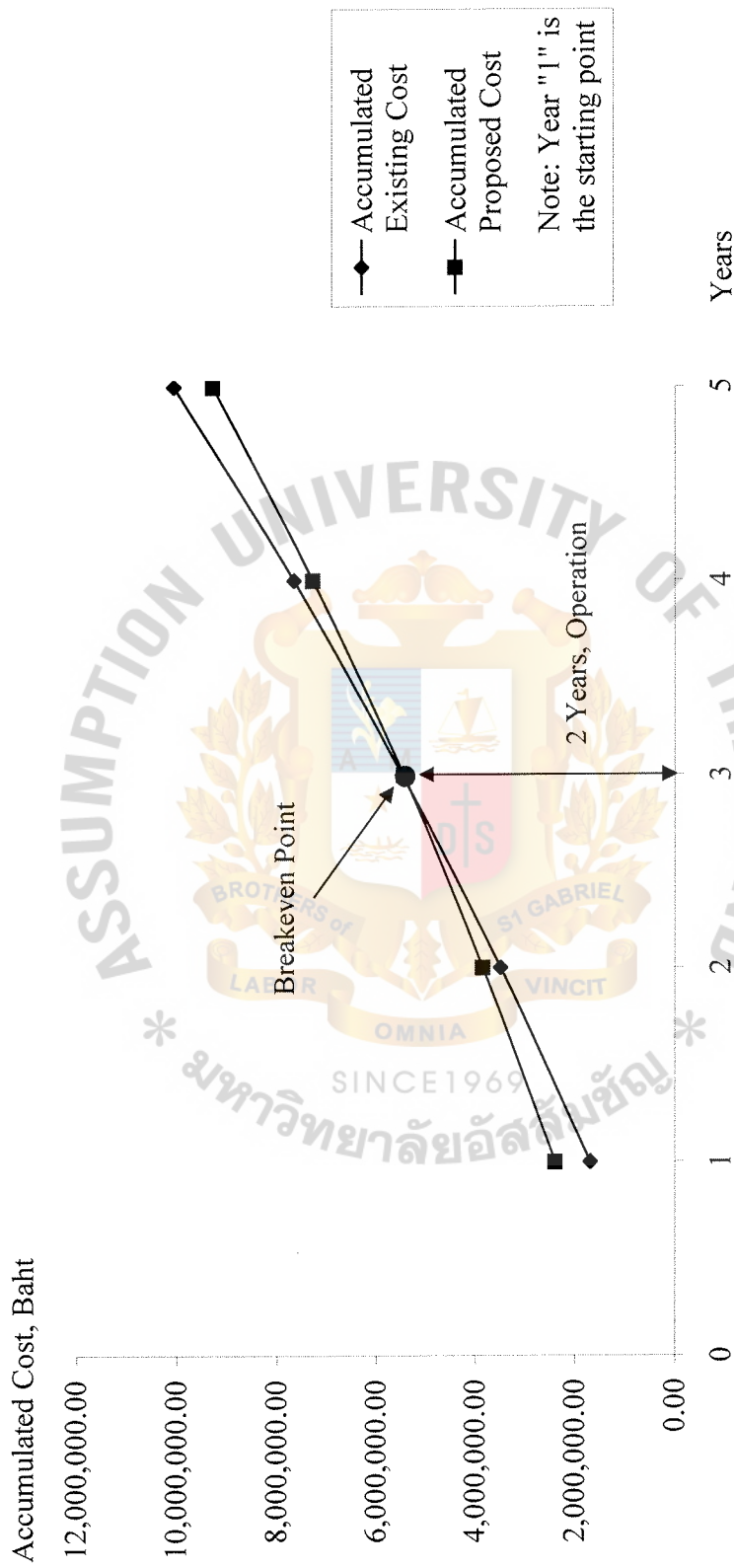


Figure 3.5. Cost Comparison between Existing System and Proposed System.

#### (4) Benefits Analysis

Benefits can be classified into Tangible Benefits and Intangible Benefits.

##### (1) Tangible Benefits

They compose of staffs reduction, operating time saving, and office supplies expense reduction. These benefits have an expected growth rate of 10% per annum. The details of tangible benefits from implementing the proposed system are as follows:

###### (a) Staffs Reduction

The number of staffs after the proposed system is put into the operation can be reduced because all jobs can be done easier using the web-based computerized system. Therefore, the fewer staff members can perform the same number of jobs. All departments can reduce one staff member each that means the company can save from paying the salary to those staffs.

###### (b) Operating Time Saving

With the web-based computerized system, the same process can be done with the less period of time because some tasks are eliminated, while the others are done easier. Therefore, amount of time used to carry out all processes as in manual system each day for each staff can be reduced. Those saved times can be considered as benefits because the staff can use it to perform other jobs.

###### (c) Office Supplies Expense Reduction

When the company transforms from manual system into computerized system, the expenses from both papers and stationeries will be reduced because the cost of paper used in manual system is higher than the cost of paper used in computerized system. This happens because the book for invoice, billing note, and purchase order are ordered specially for the company, so that it is more expensive than the blank paper used for printer in computerized system. Cost of carbon paper will be eliminated, and the number of stationeries used will be reduced because all documents are printed out.

(2) Intangible Benefits

(a) Customer Dissatisfaction Reduction

The customer dissatisfaction, which results in loss of sale, may come from many causes including slow in respond to the customer order or information inquiry from customer.

Sometimes, customer may face with the out of stock situation and some of them can't wait for the out of stock product, which will result in their dissatisfaction and they may finally go to the competitor. However, with the web-based computerized system, all the causes mentioned previously that lead to customer dissatisfaction could be reduced which lead to increased sale volume and result in increased revenue.

(b) Processing Error Reduction

In the manual system, the processing error, which will result in loss of money, can occur in many ways such as wrong



calculation of invoice or billing note, misunderstand from unclear handwriting and so. The company can reduce the loss from processing error because of computerized system. The staff doesn't need to write or calculate because computer does the process, which is more reliable.

Table 3.17. Tangible Benefits of Computerized System.

Benefits	Baht
Staffs Reduction:	
Merchandising 1 Persons @ 12,000	12,000.00
Sales and Marketing 1 Persons @ 13,500	13,500.00
Finance and Accounting 1 persons @ 15,000	15,000.00
Total Monthly Salary Expense	40,500.00
Total Annual Salary Expense	486,000.00
Operating Time Saving:	
Merchandising 1 Persons @ 2 Hours/Day	28,000.00
Sales and Marketing 2 Person @ 2 Hours/Day	50,000.00
Finance and Accounting 1 persons @ 2 Hours/Day	38,000.00
Total Annual Operating Time Saving	116,000.00
Office Supplies Expense Reduction:	14,000.00
Customer Dissatisfaction Reduction:	750,000.00
Processing Error Reduction:	350,000.00
Total Benefit	1,716,000.00

Table 3.18. Summarized Five Years Benefits of the Proposed System, Baht.

Benefits	Year				
	1	2	3	4	5
Staffs Reduction:					
Merchandising					
1 Persons @ 12,000	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Sales and Marketing					
1 Persons @ 13,500	13,500.00	14,850.00	16,335.00	17,968.50	19,765.35
Finance and Accounting					
1 persons @ 15,000	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Monthly Salary Expense	40,500.00	44,550.00	49,005.00	53,905.50	59,296.05
Total Annual Salary Expense	486,000.00	534,600.00	588,060.00	646,866.00	711,552.60
Operating Time Saving:					
Merchandising					
1 Persons @ 2 Hours/Day	28,000.00	30,800.00	33,880.00	37,268.00	40,994.80
Sales and Marketing					
2 Person @ 2 Hours/Day	50,000.00	55,000.00	60,500.00	66,550.00	73,205.00
Finance and Accounting					
1 persons @ 2 Hours/Day	38,000.00	41,800.00	45,980.00	50,578.00	55,635.80
Total Annual Operating Time Saving	116,000.00	127,600.00	140,360.00	154,396.00	169,835.60
Office Supplies Expense Reduction:	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Customer Dissatisfaction Reduction:	750,000.00	825,000.00	907,500.00	998,250.00	1,098,075.00
Processing Error Reduction:	350,000.00	385,000.00	423,500.00	465,850.00	512,435.00
Total Benefit	1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60

## (5) Break-even Analysis

Break-even Analysis is a technique used to show the point where the accumulative cost of the existing system is equal to the accumulative cost of the proposed system. Initially, the cost of the proposed system is higher than the cost of the proposed system. This difference comes from the development cost incurred at the first year of the new system implementation. However, in the long run, the proposed system can reduce the annual operating cost, especially salary cost and office supplies cost.

The break-even point is the period when cost difference of both existing and proposed system is equal to zero. This can be calculated with interpolation technique by summing the number of years, where the cost difference between both systems is still positive and fraction of year, where the cost difference is still positive (See full details of break-even analysis calculation on Appendix C).

## (6) Payback Period Analysis

Payback period analysis is a commonly used technique to evaluate the investment value of the project. It is a method for determining if and when an investment will pay for itself. It represents a time period that cash inflow can recover all initial investment of the project. To reflect the real value of money, the time value of money concept also applies in this analysis. The discount rate is required to calculate the discount value of all costs and benefits after the first year back to present value at the present year. If the payback period is performed without time adjusting the costs and benefits, which is the time value of the money, this non-time-adjusted paybacks tend to over-optimistic and misleading.

Payback period analysis measures how quickly the project will return its original investment. In order to evaluate the investment, the maximum payback period must be specified. The specified payback period is based on the management perspectives on size of investment, which is around three to five years.

Payback period is, generally, represented in the number of years that comes from dividing initial cash outflows by cash inflows. The project will be accepted only when it is less than or equal to the maximum payback period that has previously been specified.

Table 3.15. and Figure 3.6. show the payback period of the proposed computerized system that has already been calculated to evaluate the candidate solution (See full details of payback period analysis calculation on Appendix C).

Payback period is represented in the number of years that come from dividing initial cash flows by cash inflows. The project will be accepted only when the payback period is less than or equal to the maximum payback period, which has previously been specified. For this proposed computerized project, the predefined payback period is 3 years, and the discount rate is 0.75% per annum as per the current deposit interest rate.

The lifetime costs are gradually increasing over the five-year period because operating costs are being incurred. But it also can be noticed that the lifetime benefits are occurring at a much fast pace. The result of payback period is 2 year 6 months, which is less than the predefined maximum desired 3-year payback period. Thus, this proposed project is

acceptable to implement with the return on investment to recover the initial investment within two years.



Table 3.19. Payback Period Analysis of the Proposed System, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-1,069,190.00					
Operation and Maintenance Cost		-1,323,000.00	-1,455,300.00	-1,600,830.00	-1,837,291.50	-2,013,382.80
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633
Time-adjusted Costs	-1,069,190.00	-1,313,151.36	-1,433,713.65	-1,565,344.93	-1,783,190.93	-1,939,550.45
Cumulative time – adjust cost over Lifetime	-1,069,190.00	-2,382,341.36	-3,816,055.01	-5,381,399.94	-7,164,590.87	-9,104,141.32
Benefits derived from Operation of Proposed system		1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633
Time-adjusted Benefits		1,703,225.81	1,859,601.38	2,030,334.01	2,216,741.85	2,420,264.05
Cumulative time – adjust benefits over Lifetime		1,703,225.81	3,562,827.18	5,593,161.19	7,809,903.04	10,230,167.09
Cumulative Lifetime – adjusted costs – benefits	-1,069,190.00	-679,115.56	-253,227.83	211,761.25	645,312.17	1,126,025.77



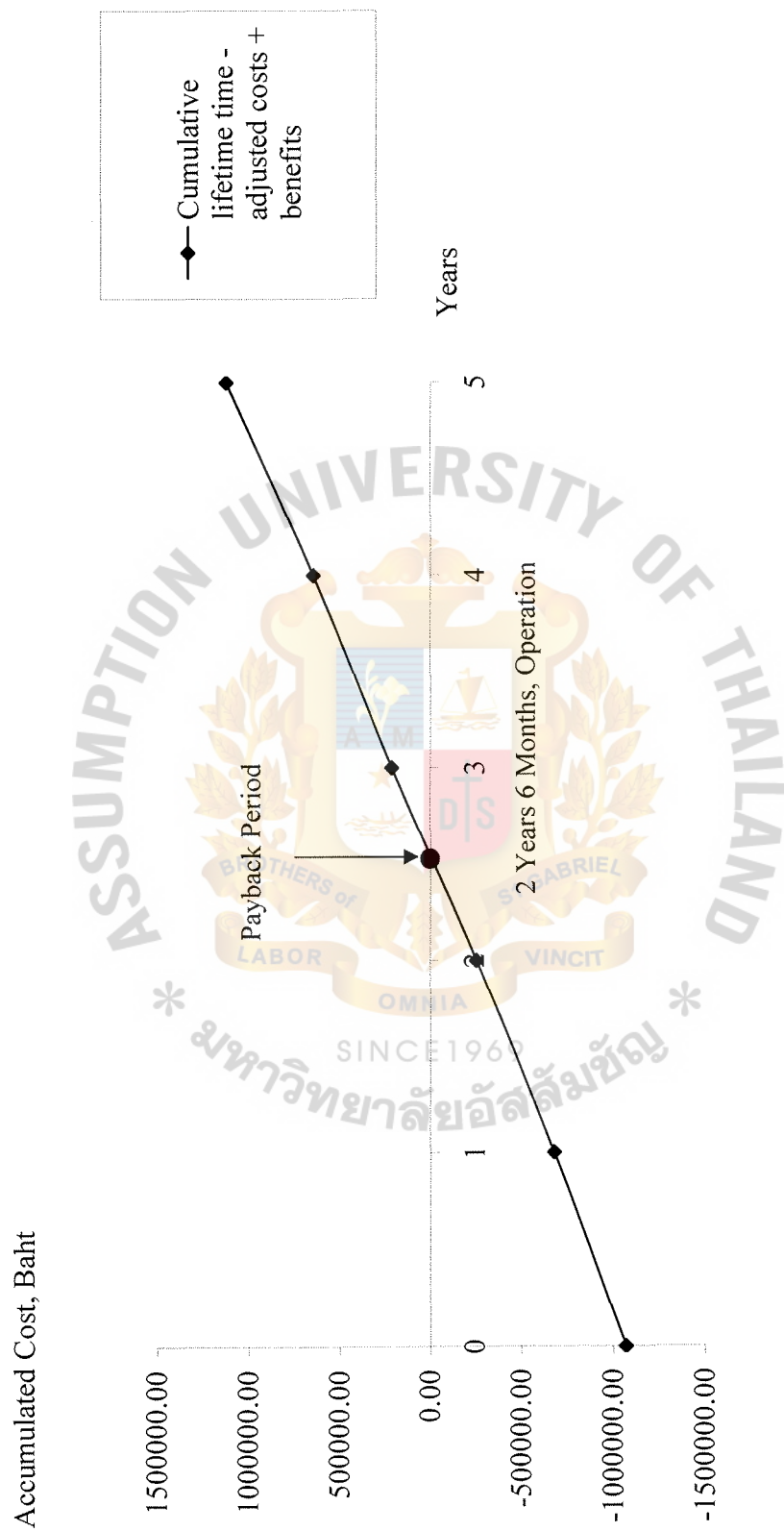


Figure 3.6. Payback Period Analysis of the Proposed System.

## (7) Net Present Value Analysis

Net present value analysis is the discount cash flow approach for evaluating the most effective investment alternatives. The cash flow includes both cash inflows and outflows from the system implementation.

The discount rate must be set to calculate the present value of all cash flows in the project. The discount rate is the required rate of return on investment that generally equals to the current interest rate, which investment amount would receive, if the investment is not made.

After all required parameters are collected, calculation will be done. Then, the calculation results will be used to ranking the investment alternatives. The project will be accepted only when its net present value is greater than zero. If all alternatives have the positive net present value, the decision will be made on the net present value. Whichever alternative gives the highest net present value, that alternative will be selected.

For the proposed computerized system, the required rate of return is equal to the current deposit interest rate, which is 0.75% per annum. The analysis indicates that net present values of all candidates are positive. But, candidate 2 gives net present value of 1,126,025.78 Baht, which is the highest value among all alternatives.

Table 3.20 shows the net present value of the proposed computerized system that has already been calculated to evaluate the candidate solution (See more detailed calculation of the net present value analysis for each candidate on Appendix C).

Table 3.20. Net Present Value Analysis of the Proposed System, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development Cost	-1,069,190.00						
Operation and Maintenance Cost		-1,323,000.00	-1,455,300.00	-1,600,830.00	-1,837,291.50	-2,013,382.80	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Cost	-1,069,190.00	-1,313,151.36	-1,433,713.65	-1,565,344.93	-1,783,190.93	-1,939,550.45	
Total Present Value of Lifetime Costs							-9,104,141.32
Benefits derived from Operation of Proposed system		1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Benefits		1,703,225.81	1,859,601.38	2,030,334.01	2,216,741.85	2,420,264.05	
Total Present Value of Lifetime Benefits							10,230,167.10
Net Present Value							1,126,025.78

(8) Return on Investment Analysis

The return on investment (ROI) analysis technique compares the lifetime profitability of the alternative solutions. The return on investment for a project is a percentage rate that measures the relationship between the amount the business gets back from an investment and the amount invested. The lifetime return on investment for a potential solution is calculated as follows:

$$\text{Lifetime ROI} = (\text{Estimated lifetime benefits} - \text{Estimated lifetime costs}) / \text{Estimated lifetime costs}$$

Table 3.21. Return on Investment Analysis, Baht.

Items	Candidate 1	Candidate 2	Candidate 3
Estimated Lifetime Benefits:	12,185,942.93	10,230,167.10	12,185,942.93
Estimated Lifetime Cost:	9,712,168.46	9,104,141.32	10,778,581.41
Calculation:	(12,185,942.93 - 9,712,168.46) / 9,712,168.46	(10,230,167.10 - 9,104,141.32) / 9,104,141.32	(12,185,942.93 - 10,778,581.41) / 10,778,581.41
Lifetime Return on Investment (ROI):	25.47%	12.37%	13.06%

## IV. PROJECT IMPLEMENTATION

### 4.1 Overview of Project Implementation

Project Implementation includes the construction and implementation of the proposed computerized information system. The construction of the proposed system is the development, installation, and testing of the system components. Meanwhile, the implementation of the proposed computerized information system is the delivery of the information system into production, which is the day-to-day operation. The typical processes of the project implementation are:

- (1) Hardware acquisition and installation
  - (a) Networks construction
  - (b) Databases construction
- (2) Software acquisition, development and installation
  - (a) Software package installation and testing
  - (b) New programs writing and testing
- (3) System testing
- (4) System conversion
- (5) Personnel training
- (6) Documentations

Moreover, the project implementation also involves fine tuning the system elements, in order to maximize the system efficiency and productivity.

- (1) Hardware acquisition and installation

The purpose for the hardware acquisition and installation is to construct, and test a functional system hardware that fulfills the business requirement and the design requirements. Moreover, it is the

implementation of the interfaces between the new proposed system and the existing production systems.

(a) Networks construction

Because the current system is a manual system which has no computer network involved in the processes, the new computers, peripheral devices and network connection devices must be purchased to form local area network for the proposed computerized information system. One server and five workstations for each department, are installed with the operating system and application software, and connected together using the switching. After the network is constructed, it must be tested to ensure functions.

(b) Databases construction

Database is constructed according to database schema in database design section. The database for the proposed system is developed by using MySQL database and installed only on server with MySQL database server as database management system (DBMS). This database construction is considered completed with unpopulated data in the database structure because the company has no data to load into the database structure. The programmer will, then, develop the program for user to enter data from the current manual system to the database.

(2) Software acquisition, development and installation

The purpose for the software acquisition, development and installation is to construct, develop, and test functional system software that fulfills the business requirement and the design requirements.



(a) Software package installation and testing

The software package is required by the proposed system to set up a web application server. Those software packages, which are installed at the server, are Apache HTTP server application, PHP web programming language, and MySQL database server. All those software packages have to be tested and checked if they work properly together.

(b) New programs writing and testing

Programmer is responsible for the developing of the programs and testing. The PHP web programming language on the Apache HTTP server is used to develop the programs for the proposed system. This web-based application must be user friendly and perform all the functions specified in the system specification section.

After finishing the program development process, it should be tested. Program testing is very important because it is the only way to verify if the system meets all the requirements.

There are three levels of testing, which are stub testing, program testing, and system testing. Stub testing or module testing is the test on each module of the program independently. Then, program testing or unit testing is performed to test an entire program. Finally, system testing which is the test to ensure that all the program in program testing can work properly together as the total system.

After all testing and program documentation is made for future reference, the proposed web-based application will be installed on the web application server.

(3) System testing

System testing is the integration of every program; we have to check if it works properly together as a system. This means that all kinds of attributes can work together properly.

(4) System conversion

This project uses the parallel conversion to convert the existing system to the new system. Both the existing system and the new system are operated for some time to ensure that all major problems in the new system have been solved before the existing system is discarded.

Before converting the existing system to the new system, the conversion plan must be prepared to serve as a guideline for the entire conversion process.

(5) Personnel training

Converting to a new system necessitates that system users be trained and provided with documentations or user manuals. Training can be performed one on one; however, group training is generally preferred. The training must be reviewed. It is a better use of time, and it encourages group-learning possibility. The benefits of training are to give more understanding of the new system to all relevant users, and the system administrators to configure and maintain the system.

(6) Documentations

The system documentations or user manuals will guide the system user through using the new system. Before the new system is fully implemented, the documentations must be prepared. The document that

may prove useful in developing the new system must be collected. The user manuals must cover all the system functions.

## **4.2 Test Plan and Result**

Project implementation is to assure that the new system can work properly and fulfills the project objectives. The test plan can be categorized into main tests: network, database and program testing.

### **(1) Network testing.**

Before designing or constructing some of the database, we believe that the infrastructure must be built and tested first. As the restaurant database must be shared or used or accessed, the restaurant has to ensure that the network that links between all servers and clients can work well and tolerate the traffics or overloaded works.

### **(2) Database testing.**

After the network testing has been tested properly, the database specialist should review the database design and manage a centralized database. Next, the database specialist should work on SQL program and test it whether each of information is recorded and stored accurately or not.

### **(3) Code and Test new programs**

The company decided to code the program using the web programming languages. After the program or script has been coded, the company needs to prototype such program or script to be tested first. There are 3 levels of testing which are as follows:

#### **(a) Stub testing or module testing.**

The company will perform a test from the smallest point and test each module by module. The company will not perform a test from

the whole program or system at once. This test is to ensure that every module will work properly.

(b) Unit testing or program testing

By integrating all modules of each program, the company will perform a test at once for all module of each program.

(c) System testing

By integrating every program, the company will see if all the programs can work together within a system. It means that whether all kinds of attributes such as order transaction database, product database, staff database, and the coded program are compatible and work together properly.

After the company has finished testing on every part of the system, the company will install the database, application program, and train the staffs in order to have the same standard and understand clearly and the convert to the new proposed information system.

#### **4.3 Training and Conversion**

Parallel conversion is used for the conversion stage. For parallel conversion, both the existing system and the new proposed systems are operated for some periods of time. This is done to ensure that all major problems in the new proposed system have been solved before the existing system is discarded. This strategy minimizes the risk of major flaws in the new proposed system causing irreparable harm to the business.

Meanwhile, the end-user and other relevant staff have to be trained to use the new computerized system. Especially, the computer training course from the software development company and other computer skills are required. Since the existing system is based on manual work, it needs to make sure that all the end-users and most of the

staff in the company believe and rely on the information technology. In order to do so, the company should provide some seminars to the staffs to learn more on information technology and practice using computer.

When the end-users are familiar to the computer, the existing system should slowly be terminated. The system analysts should work closely with the end-users at this time for helping them solving some problems. Besides, the company should organize some manual books of practice for the end-users can have the self-study or some basic problems solving for the computerized system with more effectiveness.



## V. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

After the proposed computerized information system has been assessed for economic feasibility, it reveals the payback period of 2 years 6 months, net present value of 1,126,025.78 Baht and annual return on investment of 12.37%. The investment in the proposed system is considered as a good investment because the payback period and the annual return on investment conform to the company standard and net present value results in positive. In addition, the comparison on system cost between the current cumulative system cost and the proposed cumulative system cost reveals the break-even point at the period of 2 years operation.

In the current system, all processes are done manually, which may take time to finish a particular process with an inaccuracy, and redundancy. The proposed computerized information system aims to eliminate the undesired characteristics of the manual system. With the web-based application, it will help the staffs to carry on the jobs easier, as the computer can process more accurately and faster.

For example, the customer can buy the products online via the company's web site. The customers can select the products and fill in the order form by themselves. In the meantime, the system will calculate the total amount automatically before generating the invoice on screen and to the printer.

Comparing to the existing manual system of the same process, the customers have to visit the store to select the products. Then, sales staff will issue the invoice by handwriting and calculate the total amount by using the calculator which may cause slowness and inaccuracy.



Database stored on server can help eliminate redundancy and improve data store because all information is stored systematically in one place. This is the difference from manual system in which all the information is kept in form of paper and disperses around company that may increase the risk of loss or destroy. Moreover, some information may be kept more than once without awareness because it is not kept in a systematic way as with the database system.

Reports can also be generated more easily to the management upon request because the computer can retrieve all the information from the database to produce the reports within several second. This can be comparable to the manual system in which the report is very difficult to generate as all of the data is not stored systematically. It takes time to collect the data for a report. The comparison on time usage in each process between the current system and the proposed system is shown in the Table 5.1.

Table 5.1. Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System
Customer Response	20 Minutes	5 Minutes
Inquire Information	15 Minutes	3 Minutes
Update Process	15 Minutes	3 Minutes
Generate Report	20 Minutes	5 Minutes

The proposed system would reduce the customer response time as the customer can easily search for the information of the required product directly from the web site. Moreover, sales and marketing department can search for the information about order

details, and order status more easily, this can save time spending on looking up the document file.

Good filing system and input design, updating information is easy, accurate, and fast. The proposed information system also helps eliminate the problems of data redundancy, so the merchandising department spends less time to review and compare the details and documents.

The proposed system can generate the reports as often as required because the output designs have already been created.

## **5.2 Recommendations**

The newly developed Sales Order Entry and Order Processing System should support the advance technology to minimize updating time. This will help the process of report management and information presentation.

Moreover, using the web-based technology to develop this new Sales Order Entry and Order Processing System is very important to the company because Internet plays an important role in the world of business. It interconnects hundred of thousands of private and public networks for all times.

The company can use it to exchange information internally or communication externally with suppliers and partners. Furthermore, Internet is a new cheaper channel to communicate with the customers over the world.

The new developed web page from this project can provide the information of the product to potential customers from anywhere in the world, and they can order the products regardless of the time.

Moreover, the customer can gain the information they want directly without calling in and asking the staffs, and with the E-mail, the customers can communicate

with the company in a timely and cheaper way than traditional postal service or telephone.

This project is only a fundamental study of the system development, so it ignores some uncertain internal and external factors.

However, this system can be used as a basis for further development of comprehensive and highly effective system in the future. The fully computerized system should be established not only for this specific section but for all related sections in the organization, as well.

In the future, this system can be expanded and connected with other systems using the provided Internet technology and the web server available from this study to share the data with an external organization. Therefore, there is some sensitivity analysis that needs to be considered to fully support all related factors.

Moreover, the new developed system should be applied to the full electronic commerce to create more customer satisfaction, for example, providing full electronic funds transfer or electronic payment gateway with the banks that issue the credit card. Then, the system security has to be improved to support the users, and the database system has to be modified and updated to support a higher volume of data.



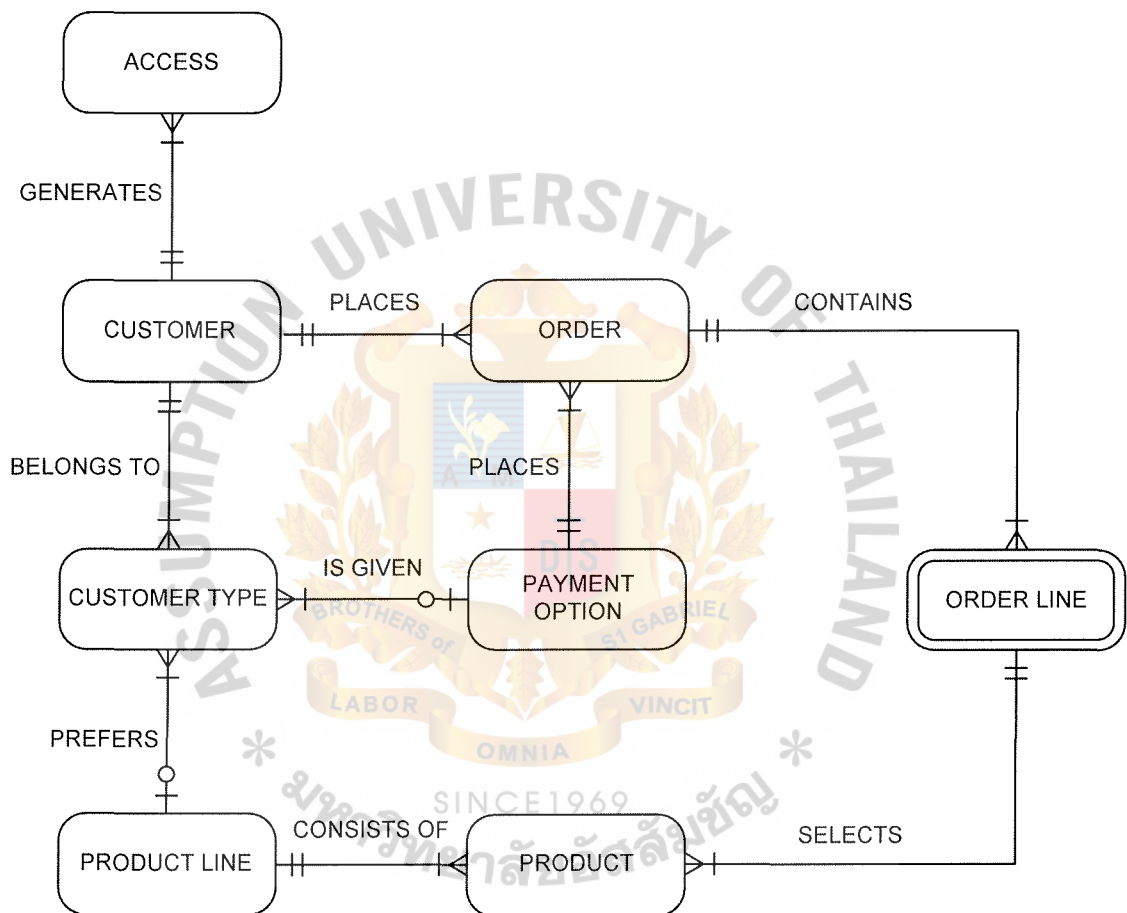


Figure A.1. Context Data Model of the Proposed System.

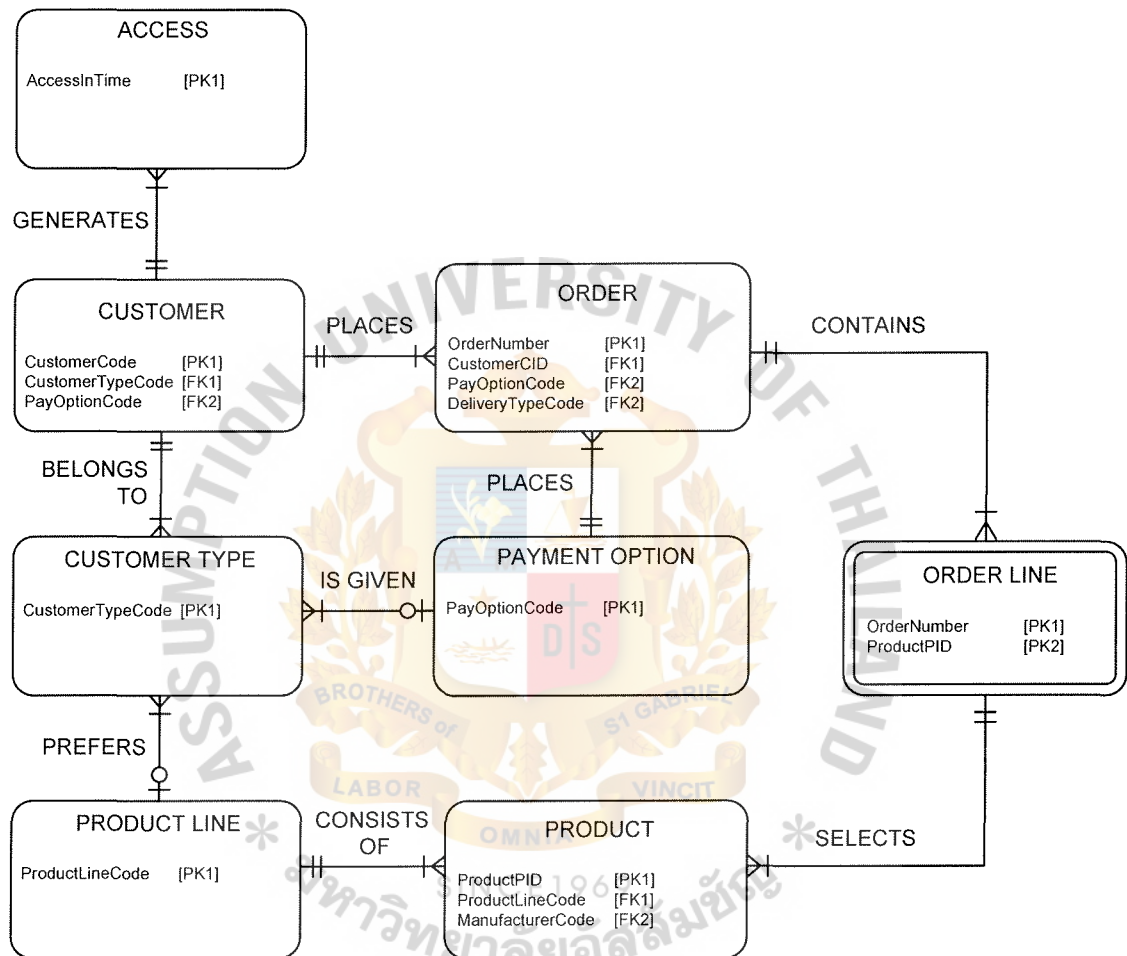


Figure A.2. Key-Based Data Model of the Proposed System.



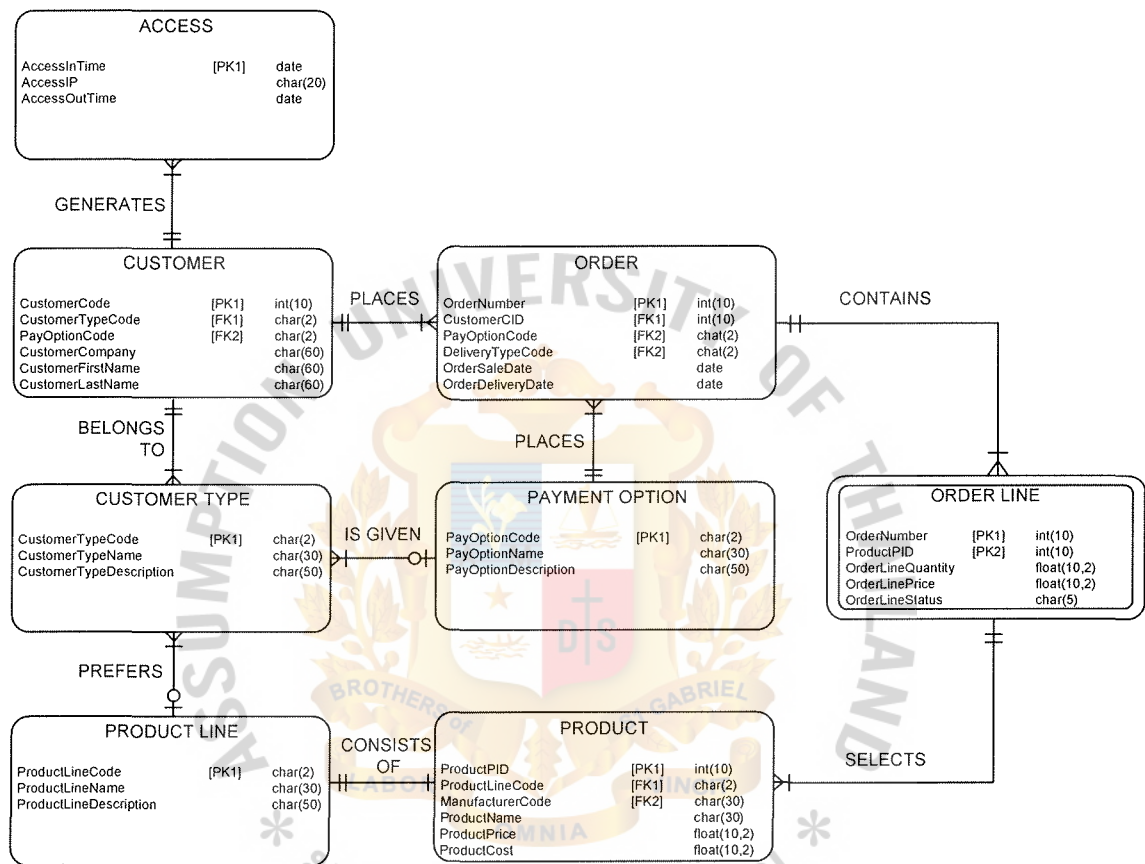


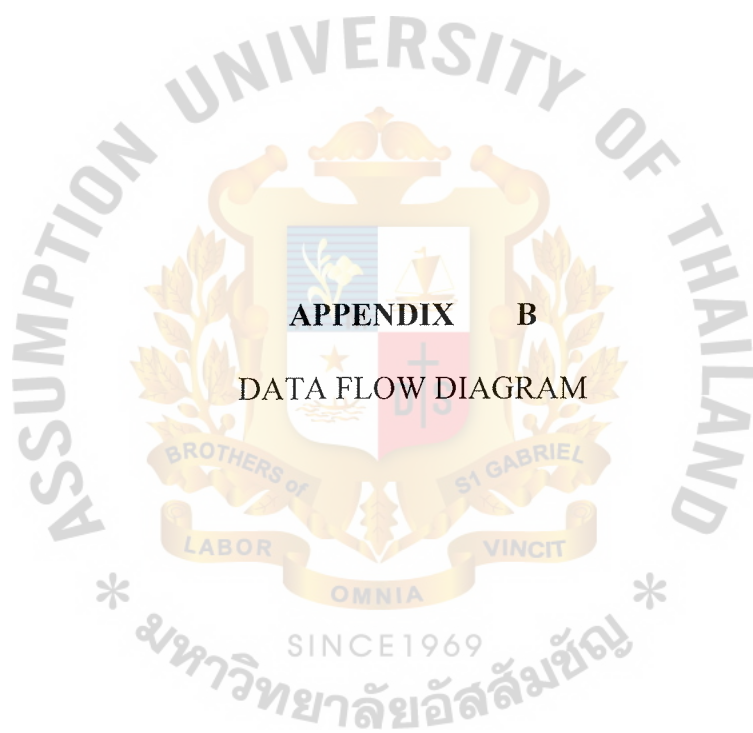
Figure A.3. Fully Attributed Data Model of the Proposed System.

Table A.1. Relationship Definition of the Entity Relationship Diagram.

Relationship	Definition
1. GENERATES	CUSTOMER GENERATES ACCESS. 1:M binary association relationship. Both CUSTOMER and ACCESS fully participate in this relationship.
2. BELONGS TO	CUSTOMER BELONGS TO CUSTOMER TYPE. M:1 binary association relationship. Each customer falls in one type of customer. Each customer type consists of many customers. CUSTOMER fully participates in this relationship.
3. PREFERS	CUSTOMER TYPE PREFERS PRODUCT LINE. M:N binary association relationship. Each type of customers prefers some product lines. Each product line may be preferred by several types of customers.
4. CONSISTS OF	PRODUCT LINE CONSISTS OF PRODUCT. 1:M binary association relationship. Each product line consists of many products. Each product falls in one product line. PRODUCT fully participates in this relationship.
5. PLACES	CUSTOMER PLACES ORDER with PAYMENT OPTION. 1:M:1 ternary association relationship. Given one customer and one particular payment type, the customer may place many orders. Given one order, it is placed by one single customer with a particular payment type. ORDER fully participates in this relationship.
6. IS GIVEN	CUSTOMER TYPE IS GIVEN PAYMENT OPTION. M:N binary association relationship. Each type of customers is given a set of valid payment options. Each payment option may be offered to some customer types. Both CUSTOMER TYPE and PAYMENT OPTION fully participate in this relationship.

Table A.1. Relationship Definition of the Entity Relationship Diagram (Continued).

Relationship	Definition
7. CONTAINS	<p>ORDER CONTAINS ORDER LINE.</p> <p>1:M binary association relationship.</p> <p>Each order contains several lines.</p> <p>Since identifying a particular order line requires an order number.</p> <p>ORDER LINE is a weak entity and depends on ORDER.</p> <p>Both ORDER and ORDER LINE fully participate in this relationship.</p>
8. SELECTS	<p>ORDER LINE SELECTS PRODUCT.</p> <p>M:1 binary association relationship.</p> <p>Each order line corresponds to a single product.</p> <p>Each product can be included in many order lines.</p> <p>Since identifying a particular order line requires a product number (besides an order number).</p> <p>ORDER LINE also depends on PRODUCT.</p> <p>ORDER LINE fully participates in this relationship.</p>



**APPENDIX B**

**DATA FLOW DIAGRAM**

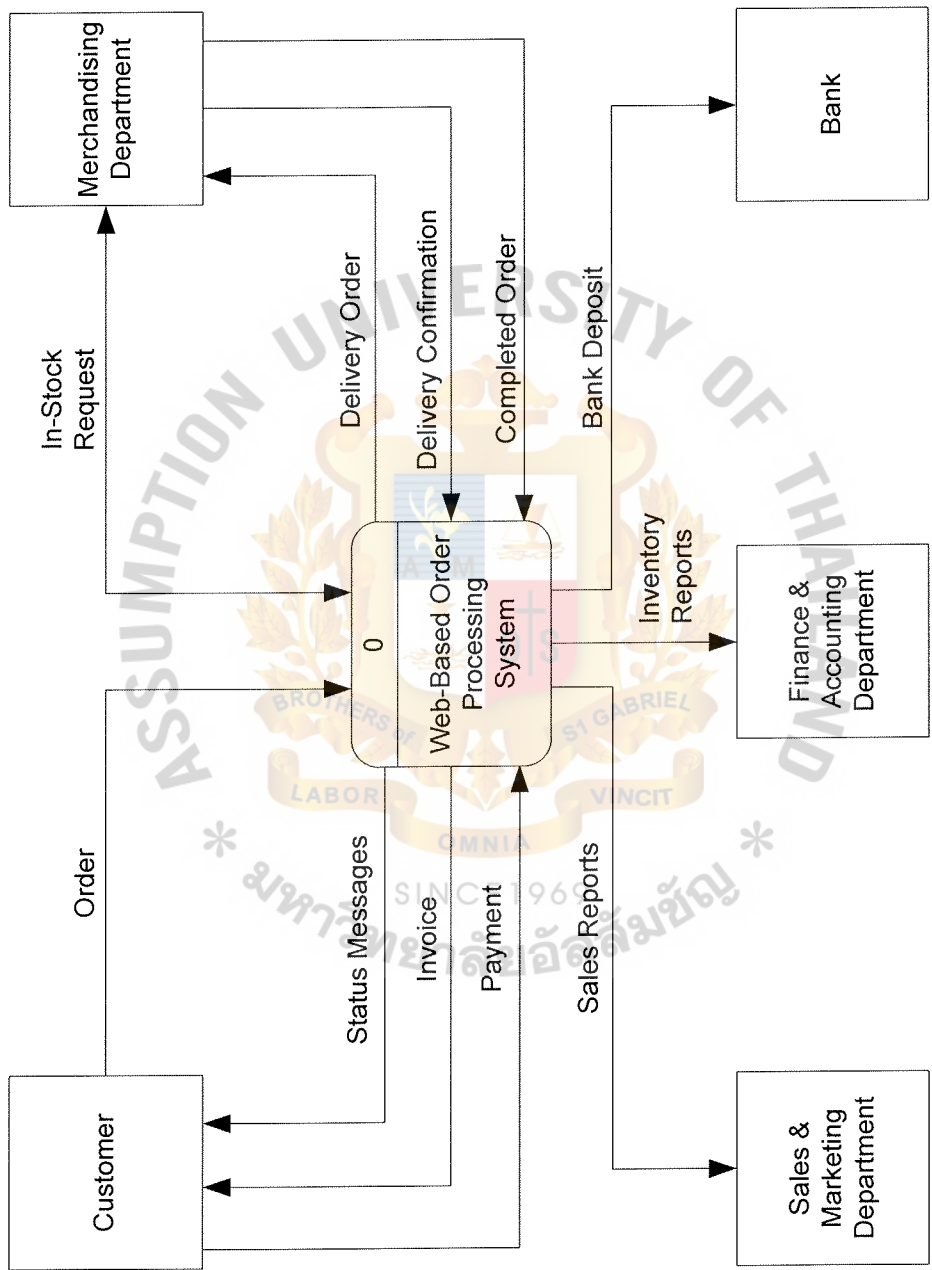


Figure B.1. Context Data Flow Diagram of the Proposed System.

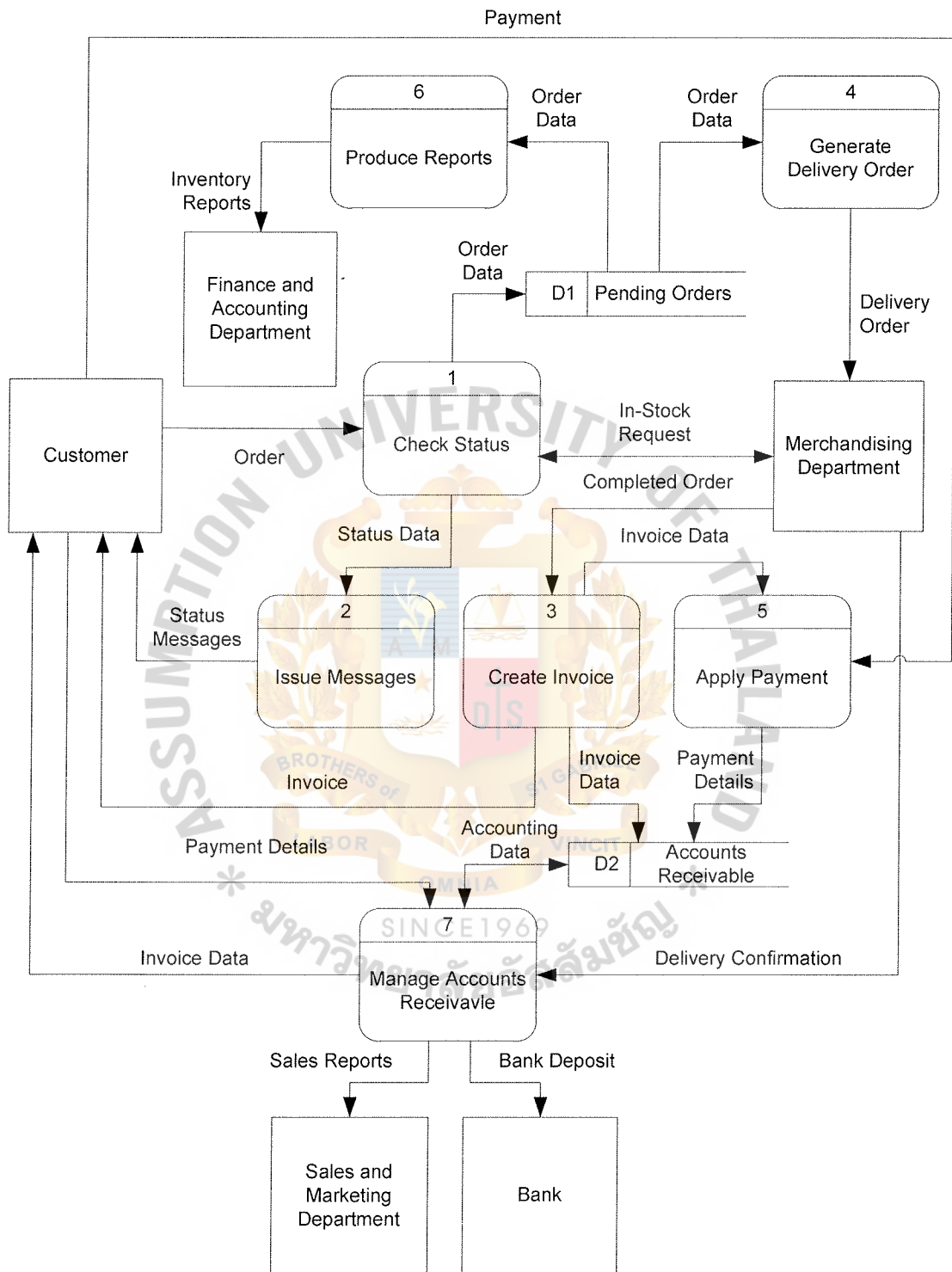


Figure B.2. Data Flow Diagram of the Proposed System.



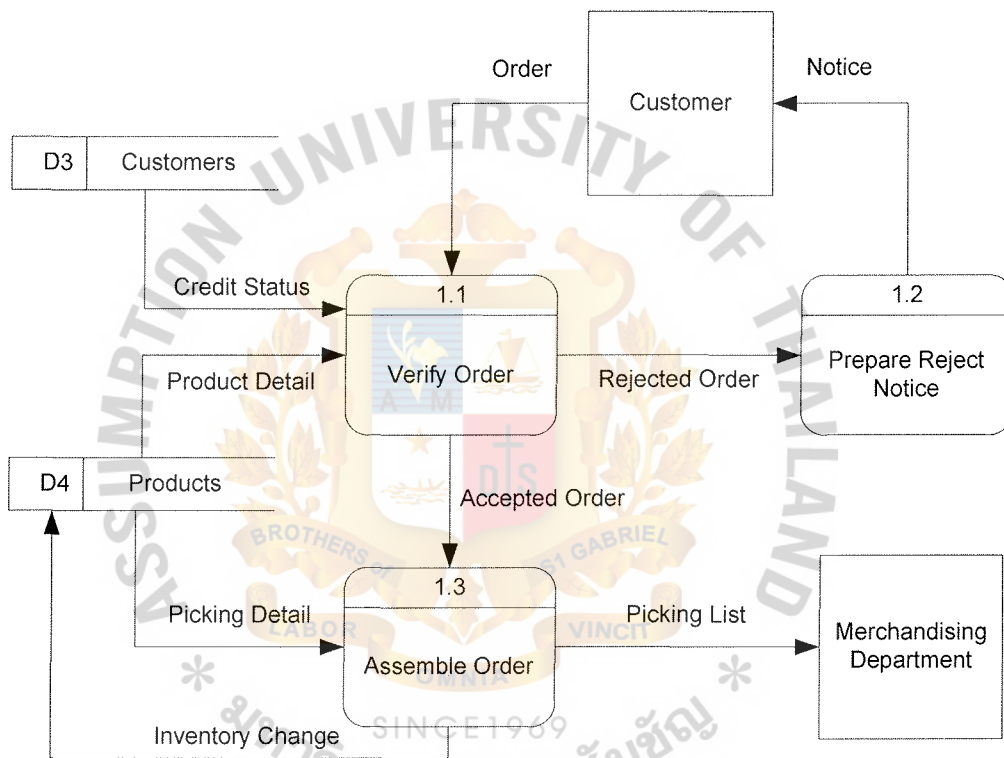


Figure B.3 Data Flow Diagram of Check Status Process.

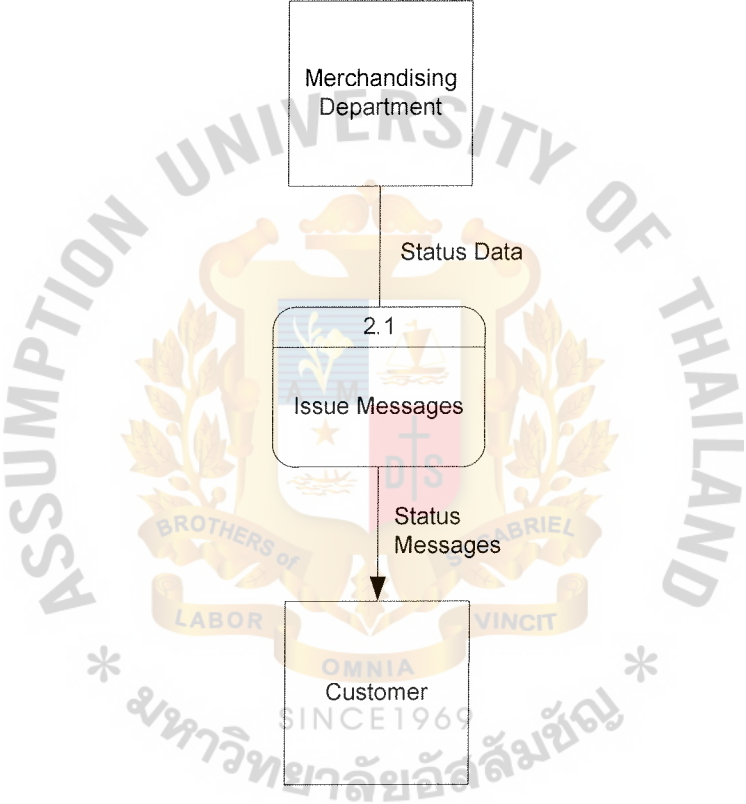


Figure B.4. Data Flow Diagram of Issue Messages Process.

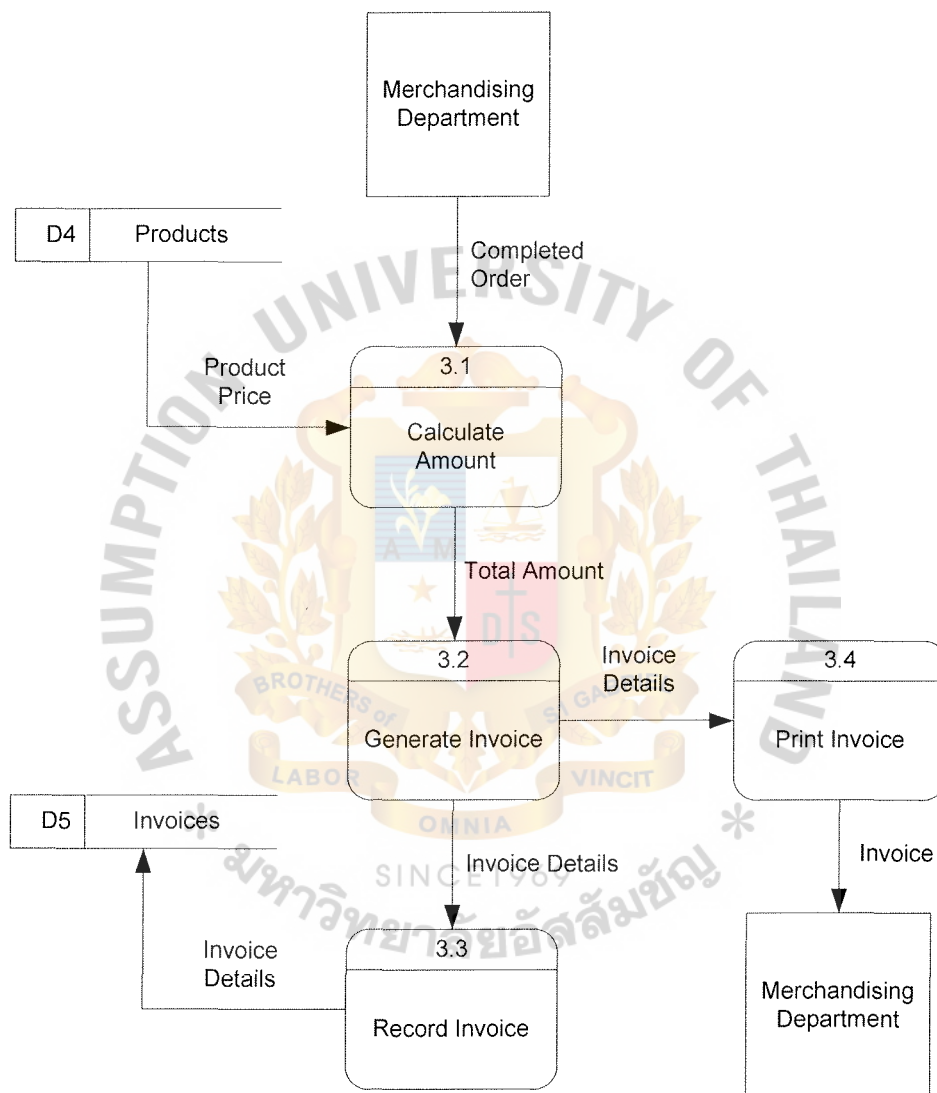


Figure B.5. Data Flow Diagram of Create Invoices Process.

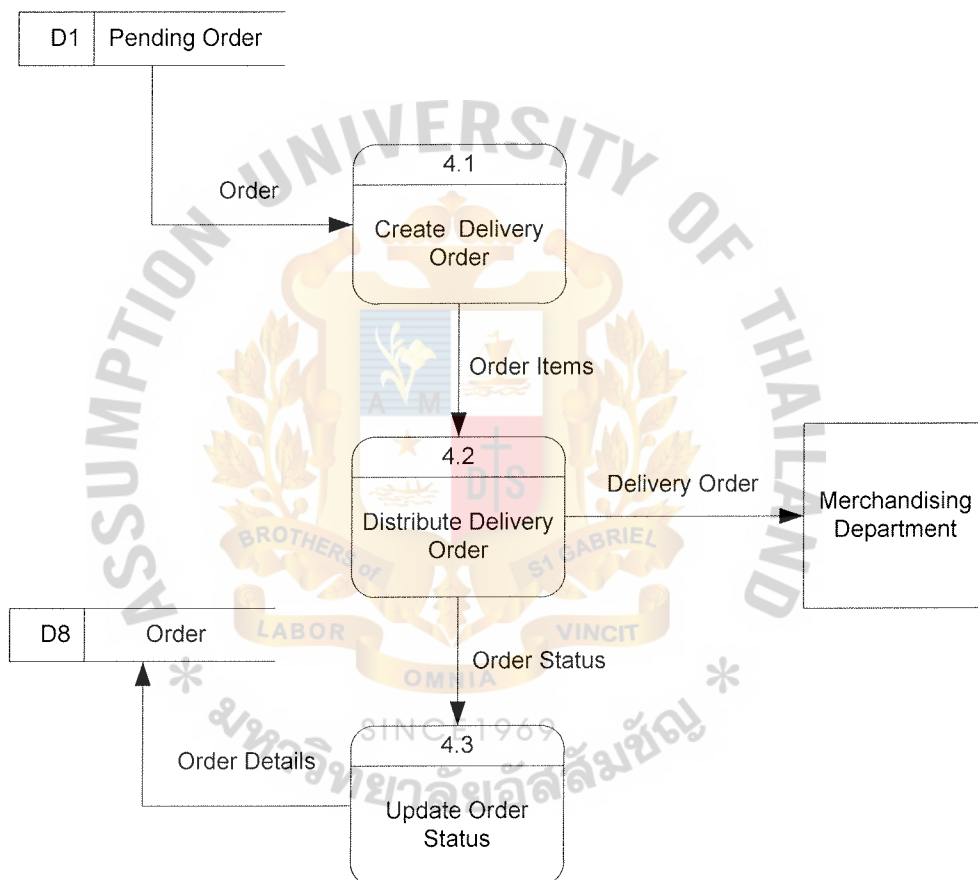


Figure B.6. Data Flow Diagram of Generate Delivery Order Process.

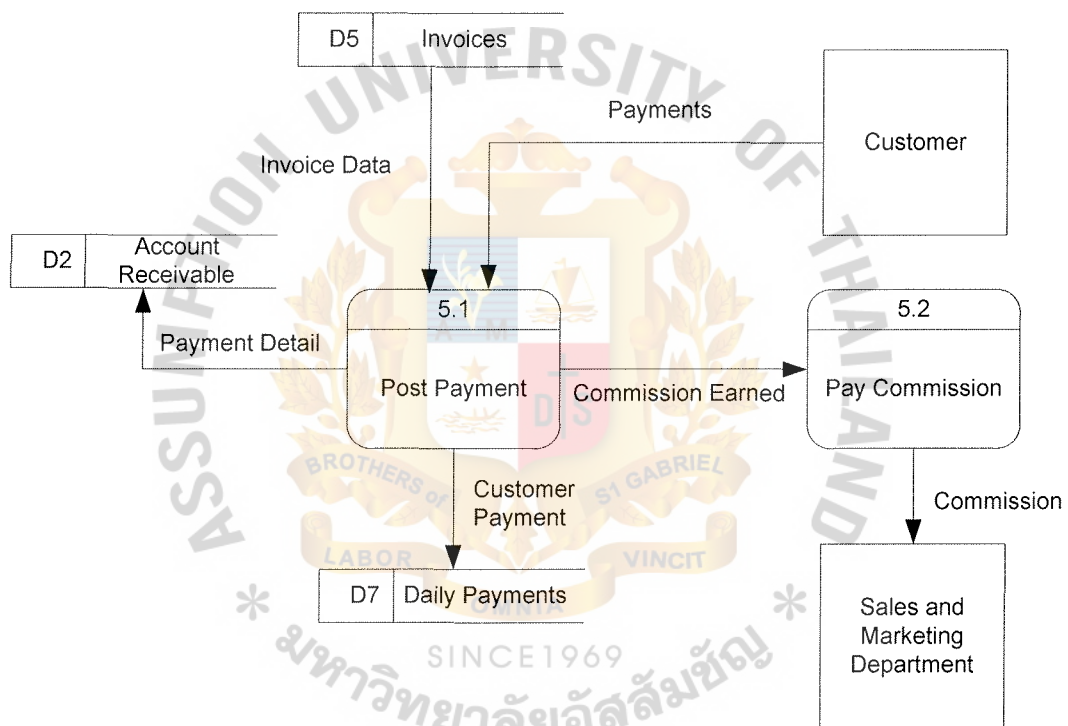


Figure B.7. Data Flow Diagram of Apply Payment Process

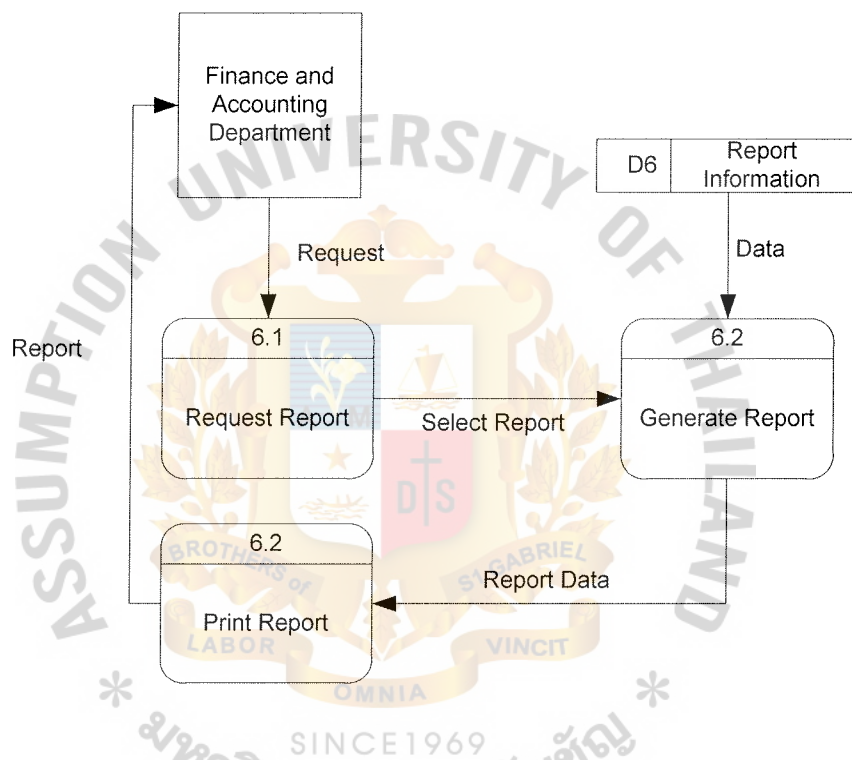


Figure B.8. Data Flow Diagram of Produce Reports Process.



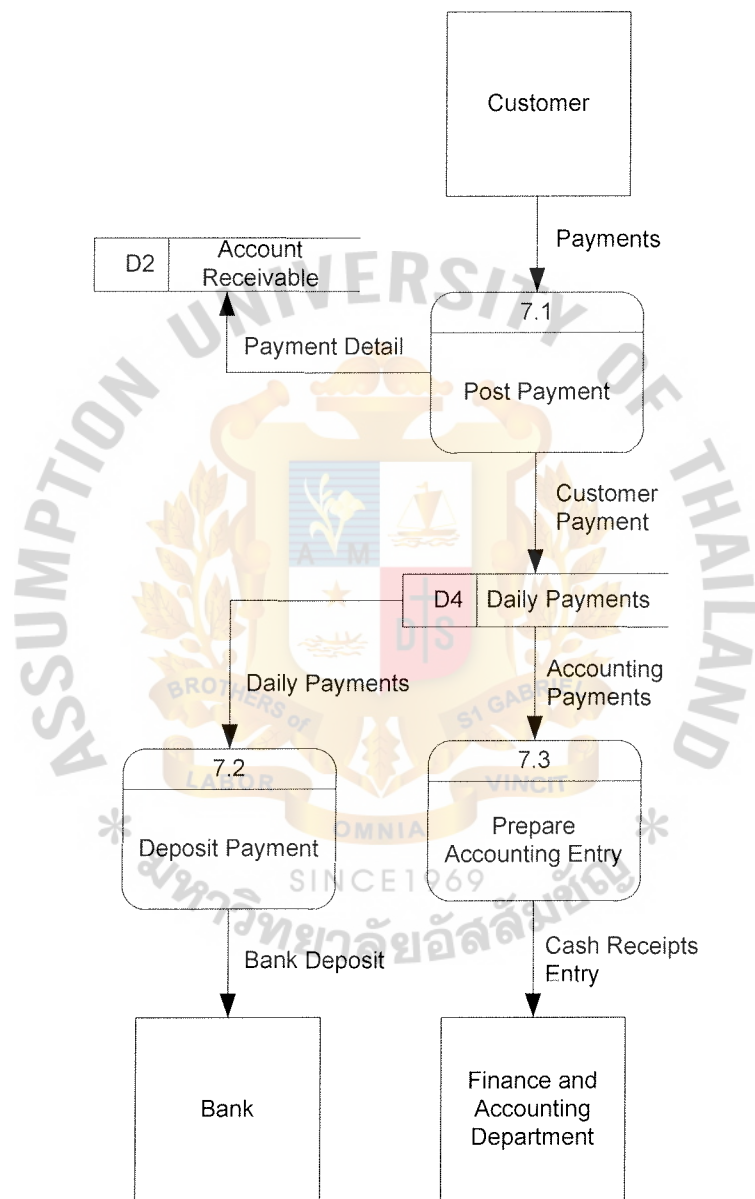


Figure B.9 Data Flow Diagram of Manage Accounts Receivable Process.



APPENDIX C  
FEASIBILITY ANALYSIS

Table C.1. Estimated Cost of Candidate 1, Baht.

Cost (Baht)	Year				
	1	2	3	4	5
<b>System Development Cost:</b>					
<b>Hardware Cost:</b>					
Server 1 Unit @ 152,690	152,690.00				
Workstation 5 Units @ 59,900	299,500.00				
Laser Printer 2 Unit @ 30,900	61,800.00				
UPS 3000VA 1 Unit @ 29,200	29,200.00				
Router 1 Unit @ 25,000	25,000.00				
Switching 1 Unit @ 25,000	25,000.00				
Total Hardware Cost	593,190.00				
System Software Package Cost	400,000.00				
Application Software Cost	300,000.00				
Installation Cost	30,000.00				
Training Cost	70,000.00				
Total Development Cost	1,393,190.00				
<b>System Operating and Maintenance Cost:</b>					
<b>Salary Expense:</b>					
President 1 Person @ 36,000	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
<b>Staff:</b>					
Merchandiser 1 Person @ 12,000	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Sales 2 Persons @ 13,500	27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Finance and Accounting 1 person @ 16,000	16,000.00	17,600.00	19,360.00	21,296.00	23,425.60
e-Business 1 person @ 15,000	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Monthly Salary Expense	106,000.00	116,600.00	128,260.00	141,086.00	155,194.60
Total Annual Salary Expense	1,272,000.00	1,399,200.00	1,539,120.00	1,693,032.00	1,862,335.20
<b>Other Expense:</b>					
Stationery Per Annual	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Papers Per Annual	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Utilities Expense Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Misc. Expense Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Other Expense	51,000.00	56,100.00	61,710.00	67,881.00	74,669.10
System Maintenance Cost	-	100,000.00	110,000.00	121,000.00	133,100.00
Total System Operating and Maintenance Cost	1,323,000.00	1,555,300.00	1,710,830.00	1,881,913.00	2,070,104.30
Total Computerized System Cost	2,716,190.00	1,555,300.00	1,710,830.00	1,881,913.00	2,070,104.30

Table C.2. Estimated Cost of Candidate 2, Baht.

Cost (Baht)	Year				
	1	2	3	4	5
<b>System Development Cost:</b>					
<b>Personnel Cost:</b>					
System Analyst 4 Months @ 32,000	128,000.00				
Programmer 4 Months @ 28,000	112,000.00				
Network Specialist 2 Months @ 30,000	60,000.00				
Total Personnel Cost	300,000.00				
<b>Hardware Cost:</b>					
Server 1 Unit @ 152,690	152,690.00				
Workstation 5 Units @ 69,900	349,500.00				
Laser Printer 2 Unit @ 31,900	63,800.00				
UPS 3000VA 1 Unit @ 28,200	28,200.00				
Router 1 Unit @ 30,000	30,000.00				
Switching 1 Unit @ 25,000	25,000.00				
Total Hardware Cost	649,190.00				
Installation Cost	50,000.00				
Training Cost	70,000.00				
Total Development Cost	1,069,190.00				
<b>System Operating and Maintenance Cost:</b>					
<b>Salary Expense:</b>					
President 1 Person @ 36,000	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
<b>Staff:</b>					
Merchandiser 1 Person @ 12,000	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Sales 2 Persons @ 13,500	27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Finance and Accounting 1 person @ 16,000	16,000.00	17,600.00	19,360.00	21,296.00	23,425.60
e-Business 1 person @ 15,000	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Monthly Salary Expense	106,000.00	116,600.00	128,260.00	141,086.00	155,194.60
Total Annual Salary Expense	1,272,000.00	1,399,200.00	1,539,120.00	1,693,032.00	1,862,335.20
<b>Other Expense:</b>					
Stationery Per Annual	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Papers Per Annual	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Utilities Expense Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Misc. Expense Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Other Expense	51,000.00	56,100.00	61,710.00	67,881.00	74,669.10
System Maintenance Cost	-	-	-	76,378.50	76,378.50
Total System Operating and Maintenance Cost	1,323,000.00	1,455,300.00	1,600,830.00	1,837,291.50	2,013,382.80
Total Computerized System Cost	2,392,190.00	1,455,300.00	1,600,830.00	1,837,291.50	2,013,382.80

Table C.3. Estimated Cost of Candidate 3, Baht.

Cost (Baht)	Year				
	1	2	3	4	5
<b>System Development Cost:</b>					
<b>Personnel Cost:</b>					
System Analyst 4 Months @ 90,000	360,000.00				
Programmer 4 Months @ 60,000	240,000.00				
Network Specialist 2 Months @ 30,000	60,000.00				
Total Personnel Cost	660,000.00				
<b>Hardware Cost:</b>					
Server 1 Unit @ 252,690	252,690.00				
Workstation 5 Units @ 79,900	399,500.00				
Laser Printer 2 Unit @ 35,900	71,800.00				
UPS 3000VA 1 Unit @ 38,200	38,200.00				
Router 1 Unit @ 35,000	35,000.00				
Switching 1 Unit @ 45,000	45,000.00				
Total Hardware Cost	842,190.00				
System Software Package Cost	600,000.00				
Installation Cost	80,000.00				
Training Cost	100,000.00				
Total Development Cost	2,282,190.00				
<b>System Operating and Maintenance Cost:</b>					
<b>Salary Expense:</b>					
President 1 Person @ 36,000	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
<b>Staff:</b>					
Merchandise 1 Person @ 12,000	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Sales 2 Persons @ 13,500	27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Finance and Accounting 1 person @ 16,000	16,000.00	17,600.00	19,360.00	21,296.00	23,425.60
e-Business 1 person @ 15,000	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Monthly Salary Expense	106,000.00	116,600.00	128,260.00	141,086.00	155,194.60
Total Annual Salary Expense	1,272,000.00	1,399,200.00	1,539,120.00	1,693,032.00	1,862,335.20
<b>Other Expense:</b>					
Stationery Per Annual	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Papers Per Annual	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Utilities Expense Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Misc. Expense Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Other Expense	51,000.00	56,100.00	61,710.00	67,881.00	74,669.10
System Maintenance Cost	-	100,000.00	110,000.00	121,000.00	133,100.00
Total System Operating and Maintenance Cost	1,323,000.00	1,555,300.00	1,710,830.00	1,958,291.50	2,146,482.80
Total Computerized System Cost	3,605,190.00	1,555,300.00	1,710,830.00	1,958,291.50	2,146,482.80

Table C.4. Payback Period Analysis of Candidate 1, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-1,373,190.00					
Operation and Maintenance Cost						
Discount factors for 0.75%	1.0000	-1,323,000.00	-1,555,300.00	-1,710,830.00	-1,881,913.00	-2,070,104.00
Time-adjusted Costs		0.9926	0.9852	0.9778	0.9706	0.9633
Cumulative time – adjust cost over Lifetime	-1,373,190.00	-1,313,151.36	-1,532,230.36	-1,672,906.59	-1,826,498.51	-1,994,191.64
	-1,373,190.00	-2,686,341.36	-4,218,571.72	-5,891,478.31	-7,717,976.83	-9,712,168.46
Benefits derived from Operation of Proposed system						
		2,116,000.00	2,287,600.00	2,476,360.00	2,683,996.00	2,912,395.60
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633
Time-adjusted Benefits		2,100,248.14	2,253,668.21	2,421,467.34	2,604,963.52	2,805,595.73
Cumulative time – adjust benefits over Lifetime		2,100,248.14	4,353,916.35	6,775,383.69	9,380,347.20	12,185,942.93
Cumulative Lifetime – adjusted costs – benefits	-1,373,190.00	-586,093.23	135,344.63	883,905.37	1,662,370.38	2,473,774.47



Table C.5. Payback Period Analysis of Candidate 2, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-1,069,190.00					
Operation and Maintenance Cost						
Discount factors for 0.75%	1.0000	-1,323,000.00	-1,455,300.00	-1,600,830.00	-1,837,291.50	-2,013,382.80
Time-adjusted Costs		0.9926	0.9852	0.9778	0.9706	0.9633
Cumulative time – adjust cost over Lifetime	-1,069,190.00	-1,313,151.36	-1,433,713.65	-1,565,344.93	-1,783,190.93	-1,939,550.45
	-1,069,190.00	-2,382,341.36	-3,816,055.01	-5,381,399.94	-7,164,590.87	-9,104,141.32
Benefits derived from Operation of Proposed system						
Discount factors for 0.75%	1.0000	1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60
Time-adjusted Benefits		0.9926	0.9852	0.9778	0.9706	0.9633
Cumulative time – adjust benefits over Lifetime		1,703,225.81	1,859,601.38	2,030,334.01	2,216,741.85	2,420,264.05
		1,703,225.81	3,562,827.18	5,593,161.19	7,809,903.04	10,230,167.09
Cumulative Lifetime – adjusted costs – benefits	-1,069,190.00	-679,115.56	-253,227.83	211,761.25	645,312.17	1,126,025.77

Table C.6. Payback Period Analysis of Candidate 3, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-2,282,190.00					
Operation and Maintenance Cost		-1,323,000.00	-1,555,300.00	-1,710,830.00	-1,968,291.50	-2,146,482.80
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633
Time-adjusted Costs	-2,282,190.00	-1,313,151.36	-1,532,230.36	-1,672,906.59	-1,910,333.53	-2,067,769.56
Cumulative time – adjust cost over Lifetime	-2,282,190.00	-3,595,341.36	-5,127,571.72	-6,800,478.31	-8,710,811.84	-10,778,581.41
Benefits derived from Operation of Proposed system		1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633
Time-adjusted Benefits		2,100,248.14	2,253,668.21	2,421,467.34	2,604,963.52	2,805,595.73
Cumulative time – adjust benefits over Lifetime		2,100,248.14	4,353,916.35	6,775,383.69	9,380,347.20	12,185,942.93
Cumulative Lifetime – adjusted costs – benefits	-2,282,190.00	-1,495,093.23	-773,655.37	-25,094.63	669,535.36	1,407,361.53

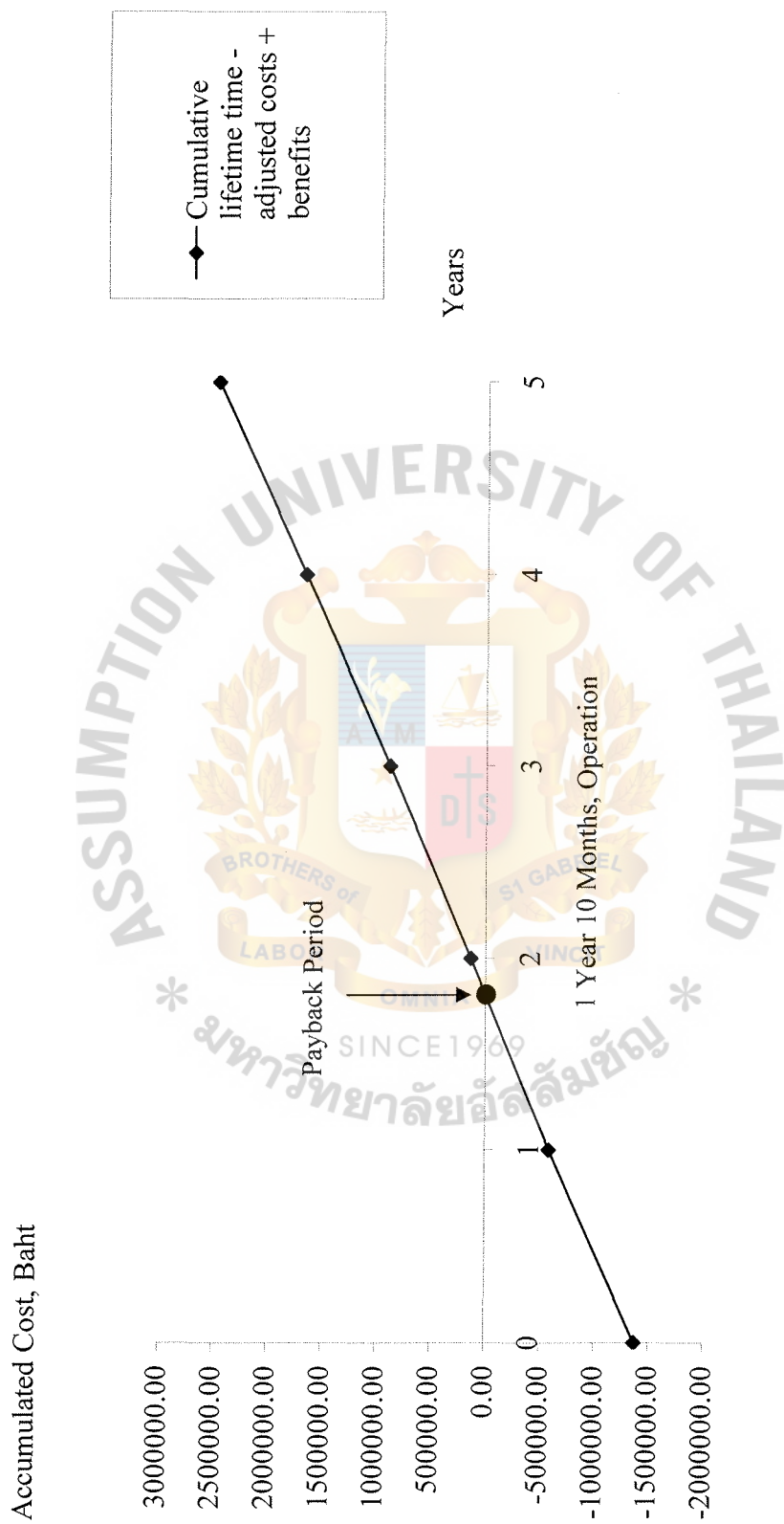


Figure C.1. Payback Period Analysis of Candidate 1.

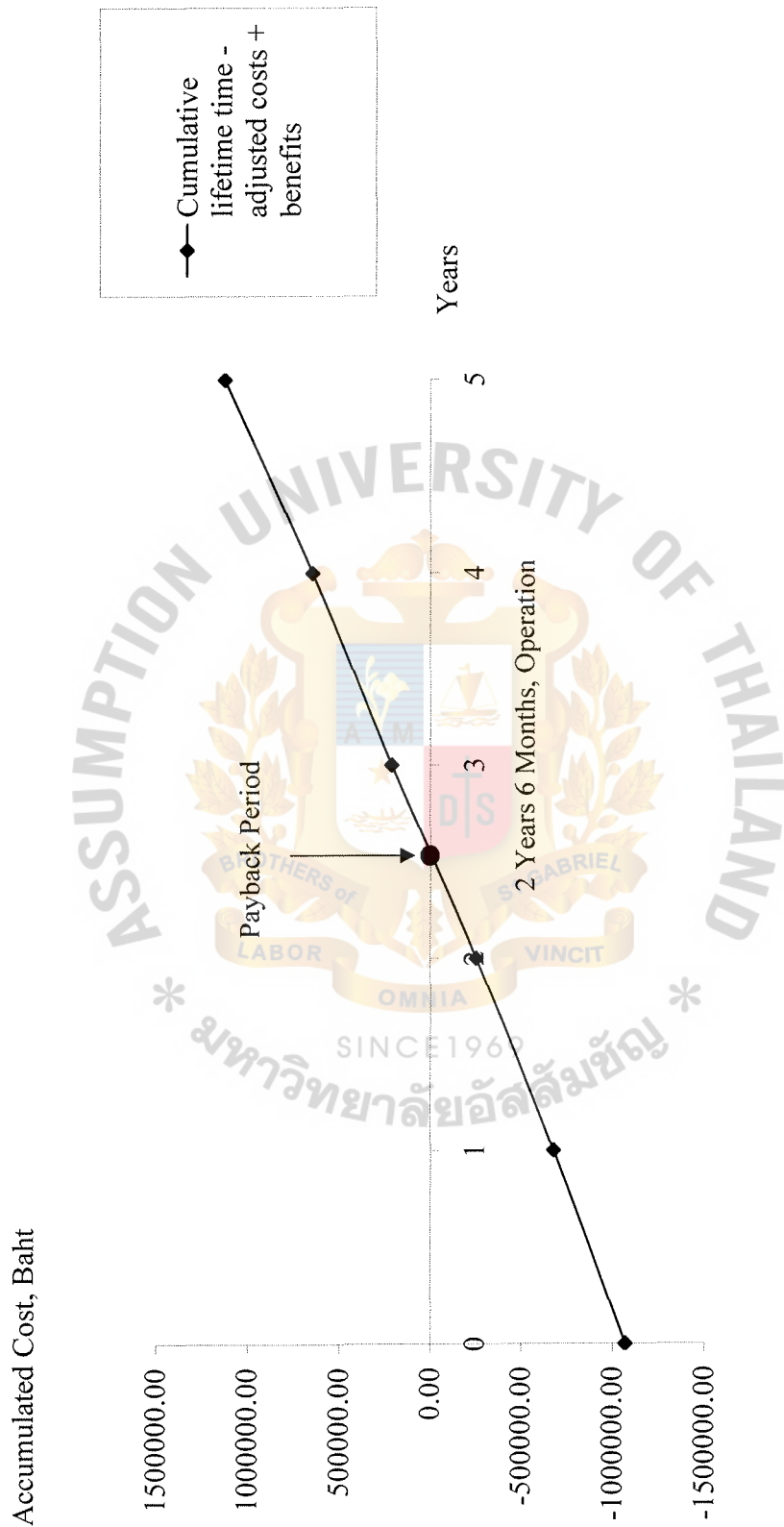


Figure C.2. Payback Period Analysis of Candidate 2.

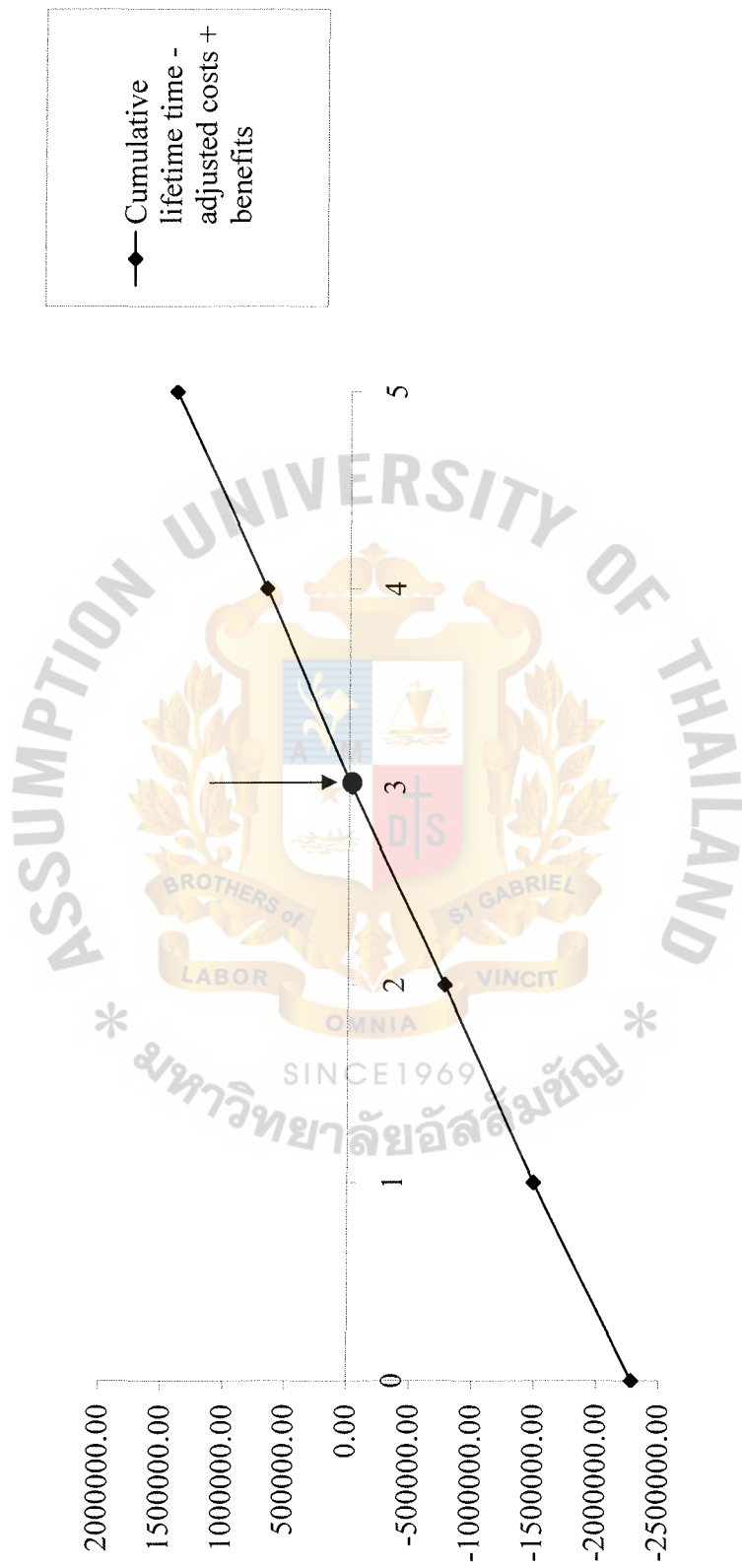


Figure C.3. Payback Period Analysis of Candidate 3.

Table C.7. Net Present Value Analysis of Candidate 1, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development Cost	-1,373,190.00						
Operation and Maintenance Cost		-1,323,000.00	-1,555,300.00	-1,710,830.00	-1,881,913.00	-2,070,104.00	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Cost	-1,373,190.00	-1,313,151.36	-1,532,230.36	-1,672,906.59	-1,826,498.51	-1,994,191.64	
Total Present Value of Lifetime Costs							-9,712,168.46
Benefits derived from Operation of Proposed system		2,116,000.00	2,287,600.00	2,476,360.00	2,683,996.00	2,912,395.60	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Benefits		2,100,248.14	2,253,668.21	2,421,467.34	2,604,963.52	2,805,595.73	
Total Present Value of Lifetime Benefits							12,185,942.93
Net Present Value							2,473,774.47



Table C.8. Net Present Value Analysis of Candidate 2, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development Cost	-1,069,190.00						
Operation and Maintenance Cost		-1,323,000.00	-1,455,300.00	-1,600,830.00	-1,837,291.50	-2,013,382.80	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Cost	-1,069,190.00	-1,313,151.36	-1,433,713.65	-1,565,344.93	-1,783,190.93	-1,939,550.45	-9,104,141.32
Total Present Value of Lifetime Costs							
Benefits derived from Operation of Proposed system		1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Benefits		1,703,225.81	1,859,601.38	2,030,334.01	2,216,741.85	2,420,264.05	10,230,167.10
Total Present Value of Lifetime Benefits							
Net Present Value							1,126,025.78

Table C.9. Net Present Value Analysis of Candidate 3, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development Cost	-2,282,190.00						
Operation and Maintenance Cost		-1,323,000.00	-1,555,300.00	-1,710,830.00	-1,968,291.50	-2,146,482.80	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Cost		-1,313,151.36	-1,532,230.36	-1,672,906.59	-1,910,333.53	-2,067,769.56	
Total Present Value of Lifetime Costs							-10,778,581.41
Benefits derived from Operation of Proposed system		1,716,000.00	1,887,600.00	2,076,360.00	2,283,996.00	2,512,395.60	
Discount factors for 0.75%	1.0000	0.9926	0.9852	0.9778	0.9706	0.9633	
Present Value of Annual Benefits		2,100,248.14	2,253,668.21	2,421,467.34	2,604,963.52	2,805,595.73	
Total Present Value of Lifetime Benefits							12,185,942.93
Net Present Value							1,407,361.53



**APPENDIX D**  
**STRUCTURE DESIGN**

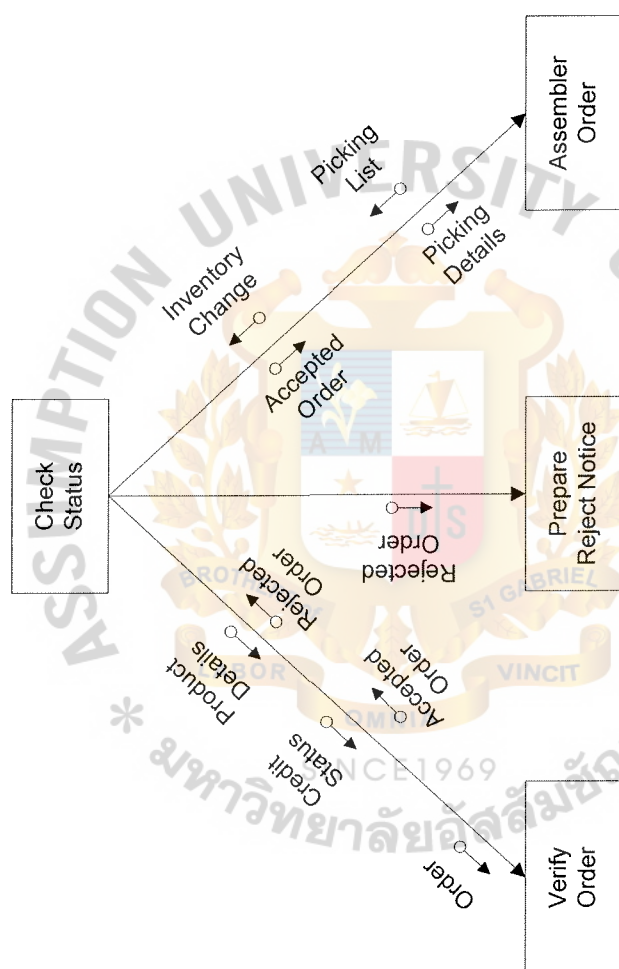


Figure D.1. Structure Chart of Check Status Process.

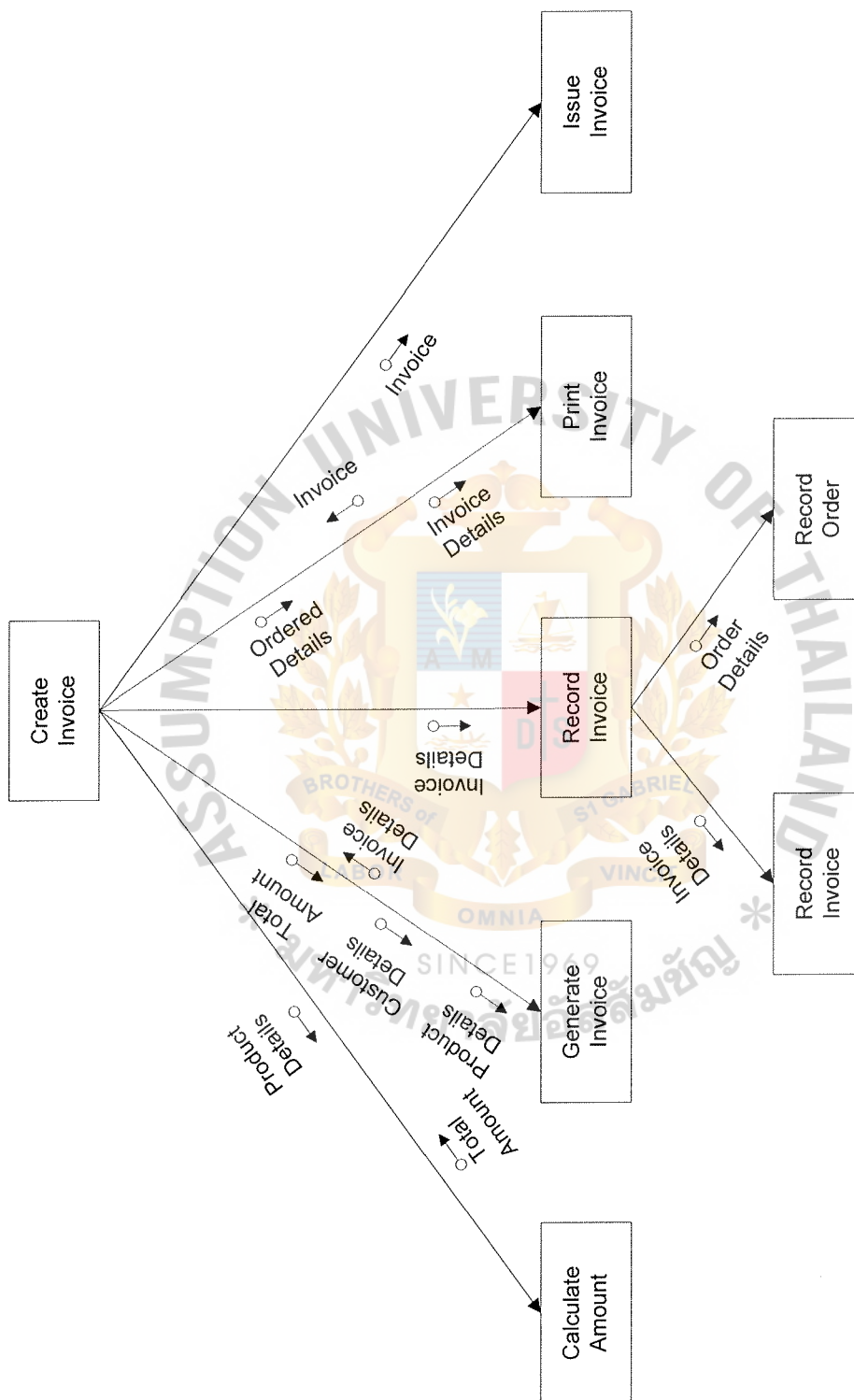


Figure D.2. Structure Chart of Create Invoice Process.

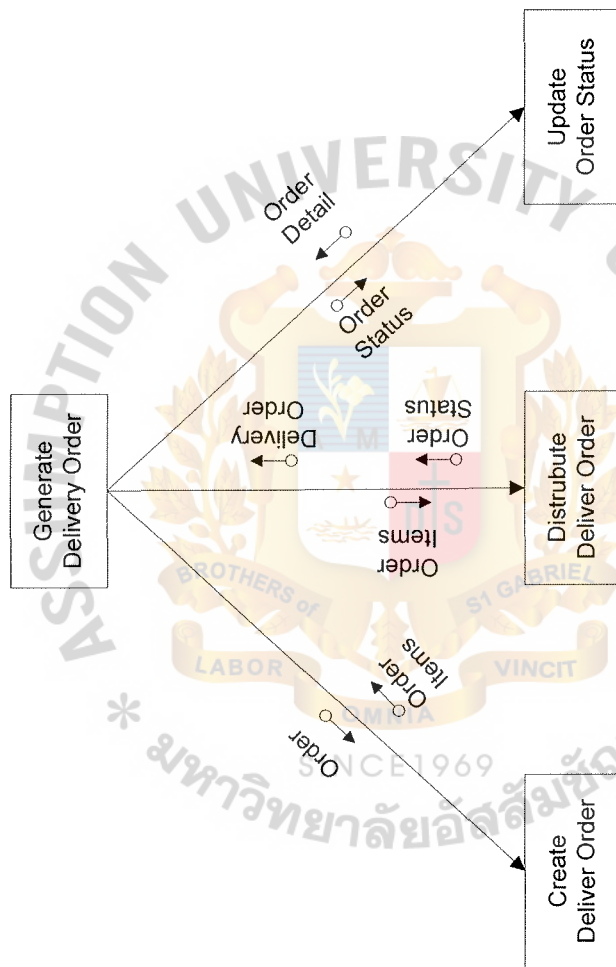


Figure D.3. Structure Chart of Generate Delivery Order Process.





## APPENDIX E

### PROCESS SPECIFICATION

Table E.1. Process Specification of Process 1.1.

Items	Descriptions
Process name:	Verify Order
Data in:	(1) Order (2) Credit Status (3) Product Detail
Data out:	(1) Accepted Order (2) Rejected Order
Process:	Check customer status and product detail
Attachment:	(1) Customer (2) Product

Table E.2. Process Specification of Process 1.2.

Items	Descriptions
Process name:	Prepare reject notice
Data in:	Rejected order
Data out:	Reject notice
Process:	Issue the reject notice to customer
Attachment:	Customer

Table E.3. Process Specification of Process 1.3.

Items	Descriptions
Process name:	Assemble order
Data in:	(1) Accepted order (2) Products picking detail
Data out:	(1) Products picking list (2) Inventory change
Process:	Prepare products picking list for Merchandising Department and update inventory change
Attachment:	(1) Data store D4 (2) Merchandising Department

Table E.4. Process Specification of Process 2.1.

Items	Descriptions
Process name:	Issue messages
Data in:	Status data
Data out:	Status messages
Process:	Receive status data from Merchandising Department and issue status messages for Customer
Attachment:	(1) Merchandising Department (2) Customer

Table E.5. Process Specification of Process 3.1.

Items	Descriptions
Process name:	Calculate amount
Data in:	Product detail
Data out:	Total amount
Process:	Calculation of amount paid
Attachment:	Sales and Marketing Department

Table E.6. Process Specification of Process 3.2.

Items	Descriptions
Process name:	Generate invoice
Data in:	(1) Product detail (2) Customer detail (3) Total amount
Data out:	Invoice detail
Process:	Generating of invoice
Attachment:	Sales and Marketing Department

Table E.7. Process Specification of Process 3.3.

Items	Descriptions
Process name:	Record invoice
Data in:	Invoice detail
Data out:	(1) Invoice detail (2) Order detail
Process:	Record invoice detail and order detail
Attachment:	Data store D5 Data store D8

Table E.8. Process Specification of Process 3.4.

Items	Descriptions
Process name:	Print invoice
Data in:	(1) Order Detail (2) Invoice Detail
Data out:	Invoice
Process:	Printing of invoice
Attachment:	Sales and Marketing Department

Table E.9. Process Specification of Process 4.1.

Items	Descriptions
Process name:	Create delivery order
Data in:	Order
Data out:	Order Items
Process:	Generate delivery order for distribution of product
Attachment:	Merchandising department

Table E.10. Process Specification of Process 4.2.

Items	Descriptions
Process name:	Distribute delivery order
Data in:	Order Items
Data out:	(1) Delivery order (2) Order Status
Process:	Distribution of delivery order with products to customers
Attachment:	Merchandising Department

Table E.11. Process Specification of Process 4.3.

Items	Descriptions
Process name:	Update order status
Data in:	Order status
Data out:	Order details
Process:	Record order status change
Attachment:	Data store D8



Table E.12. Process Specification of Process 5.1.

Items	Descriptions
Process name:	Apply payment
Data in:	(1) Invoice data (2) Payments
Data out:	(1) Payment detail (2) Commission earned (3) Customer payment
Process:	Manage the collected payment from customer
Attachment:	(1) Data store D2 (2) Data store D7

Table E.13. Process Specification of Process 5.2.

Items	Descriptions
Process name:	Pay commission
Data in:	Commission earned
Data out:	Commission
Process:	Pay commission for Sales and Marketing Department
Attachment:	Sales and Marketing Department

Table E.14. Process Specification of Process 6.1.

Items	Descriptions
Process name:	Request report
Data in:	Request from Finance and Accounting Department
Data out:	Report selection
Process:	Receive report request
Attachment:	Finance and Accounting Department

Table E.15. Process Specification of Process 6.2.

Items	Descriptions
Process name:	Generate report
Data in:	(1) Report Information (2) Report Selection
Data out:	Report data
Process:	Summarize the report
Attachment:	Finance and Accounting Department

Table E.16. Process Specification of Process 6.3.

Items	Descriptions
Process name:	Print report
Data in:	Report Data
Data out:	Report
Process:	Print out report
Attachment:	(1) Finance and Accounting Department (2) Sales and Marketing Department (3) President

Table E.17. Process Specification of Process 7.1.

Items	Descriptions
Process name:	Post payment
Data in:	Payments
Data out:	(1) Payment detail (2) Customer payment
Process:	Record payment to account receivable and daily payment for Finance and Accounting Department
Attachment:	(1) Data store D2 (2) Data store D4

Table E.18. Process Specification of Process 7.2.

Items	Descriptions
Process name:	Deposit payment
Data in:	Daily payment
Data out:	Bank deposit
Process:	Issue a bank payment deposit
Attachment:	Bank

Table E.19. Process Specification of Process 7.3.

Items	Descriptions
Process name:	Prepare accounting entry
Data in:	Accounting payment
Data out:	Cash receipt entry
Process:	Record accounting entry for future use
Attachment:	Finance and Accounting Department



**APPENDIX F**  
**DATA DICTIONARY**

Table F.1. Data Definition of the Entity Relationship Diagram.

Data Element	Definition
1. accessInTime	The time a customer enters the web site
2. accessIP	The IP address where a customer accesses the web site
3. accessOutTime	The time a customer leaves the website
4. customerCCBank	Customer credit card bank
5. customerCCExpireDate	Customer credit card expiration date
6. customerCCName	Customer name printed on credit card
7. customerCCNumber	Customer credit card number
8. customerCID	Customer identification number, which is automatically generated by the system and assigned to a customer
9. customerCity	Customer city
10. customerComment	Special instructions about a customer
11. customerCompany	Customer company
12. customerCountry	Customer country
13. customerDistrict	Customer district
14. customerEmail	Customer email address
15. customerFax	Customer fax number
16. customerFirstName	Customer first name
17. customerLastName	Customer middle name
18. customerPassword	Customer password, which should be encoded for security
19. customerPhone	Customer phone number
20. customerPostalCode	Customer postal code
21. customerProvince	Customer province



Table F.1. Data Definition of the Entity Relationship Diagram (Continued).

Data Element	Definition
22. customerStreetAddress	Customer Street Address
23. customerTitle	Customer title
24. customerTypeCode	Customer type code
25. customerTypeDescription	Additional description about customer type
26. customerTypeName	Customer type name, such as, home/office customer, small business customer, and large business customer, etc.
27. deliveryTypeCode	Delivery type code
28. deliveryTypeDescription	Delivery type description
29. deliveryTypeName	Delivery type name
30. manufacturerCity	Manufacturer city
31. manufacturerCode	Manufacturer code, which is automatically generated by the system and assigned to a manufacturer
32. manufacturerComments	Special instructions about a manufacturer
33. manufacturerCompany	Manufacturer company
34. manufacturerCountry	Manufacturer country
35. manufacturerDistrict	Manufacturer district
36. manufacturerEmail	Manufacturer email address
37. manufacturerFax	Manufacturer fax number
38. manufacturerFirstName	Manufacturer first name
39. manufacturerLastName	Manufacturer last name
40. manufacturerPhone	Manufacturer phone number
41. manufacturerPostalCode	Manufacturer postal code
42. manufacturerProvince	Manufacturer province

Table F.1. Data Definition of the Entity Relationship Diagram (Continued).

Data Element	Definition
43. manufacturerStreetAddress	Manufacturer street address
44. manufacturerTitle	Manufacturer title
45. orderAmountPaid	Order amount paid
46. orderComment	Special instructions about an order
47. orderDeliveryDate	Order delivery date
48. orderFreight	Order freight
49. orderLineComment	Special instructions about an order line
50. orderLineDeliveryDate	The date a particular product is shipped
51. orderLinePickDate	The date a particular order line is picked
52. orderLinePrice	The price of a particular product that is ordered
53. orderLineQuantity	The quantity of a particular product that is ordered
54. orderLineShipNumber	The shipment number
55. orderLineStatus	The status of an order line, each order line can be processed separately. Status can be chosen from B (Backordered), P (Picked), S (Shipped) or C (Cancelled). An order line can be cancelled only if it is in B or P status.
56. orderNumber	Order serial number, which is automatically generated by the system
57. orderSaleDate	The date when an order is placed
58. orderShippingCity	Order shipping city, which takes customer city as default unless specified otherwise
59. orderShippingCountry	Order shipping country, which takes customer country as default unless specified otherwise

Table F.1. Data Definition of the Entity Relationship Diagram (Continued).

Data Element	Definition
60. orderShippingDistrict	Order shipping district, which takes customer district as default unless specified otherwise
61. orderShippingEmail	Order shipping email address, which takes customer email address as default unless specified otherwise
62. orderShippingFax	Order shipping fax number, which takes customer fax number as default unless specified otherwise
63. orderShippingName	Order shipping name, which takes customer name as default unless specified otherwise
64. orderShippingPhone	Order shipping phone number, which takes customer phone number as default unless specified otherwise
65. orderShippingPostalCode	Order shipping postal code, which takes customer postal code as default unless specified otherwise
66. orderShippingProvince	Order shipping province, which takes customer province as default unless specified otherwise
67. orderShippingStreetAddress	Order shipping street address, which takes customer street address as default unless specified otherwise
68. orderTaxRate	Order tax rate
69. orderTerm	Order term
70. orderTotalAmount	Order total amount
71. payOptionCode	Pay option code
72. payOptionDescription	Pay option description
73. payOptionName	Pay option name
74. productCost	Product cost
75. productFeatures	Product features

Table F.1. Data Definition of the Entity Relationship Diagram (Continued).

Data Element	Definition
76. productImage	Product image
77. productLineCode	Product line code, which classifies different product lines
78. productLineDescription	Additional description about a product line
79. productLineName	Product line name, such as, desktops, notebooks, servers, software, workstations, etc.
80. productName	Product name
81. productOnHand	Product on hand, which is the actual number of products available in stock
82. productOnOrder	Product on order, which is the minimum inventory level of a particular product for the merchandising department to order the product from the manufacturer
83. productPID	Product item number, which is automatically generated by the system and assigned to a product
84. productPrice	Product price
85. staffComments	Special instructions about a staff
86. staffFirstName	Staff first name
87. staffHireDate	Staff hire date
88. staffImage	Staff image
89. staffLastName	Staff last name
90. staffPhoneExt	Staff phone extension number
91. staffSalary	Staff salary
92. staffSID	Staff Identification number, which is automatically generated by the system
93. staffTitle	Staff title



**APPENDIX G**  
**DATABASE DESIGN**

Table G.1. File Structure of Customer Types.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	customerTypeCode	char(2)	Primary Key			
2	customerTypeName	char(30)	Attribute			
3	customerTypeDescription	char(50)	Attribute	Yes	Null	



Table G.2. File Structure of Customers.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	customerCID	int(10) unsigned	Primary Key		Null	Auto Increment
2	customerTypeCode	char(2)	Foreign Key			
3	payOptionCode	char(2)	Foreign Key			
4	customerCompany	char(60)	Attribute	Yes	Null	
5	customerFirstName	char(60)	Attribute			
6	customerLastName	char(60)	Attribute			
7	customerTitle	char(20)	Attribute			
8	customerPassword	char(20)	Attribute	Yes	Null	
9	customerStreetAddress	char(50)	Attribute			
10	customerDistrict	char(30)	Attribute			
11	customerCity	char(30)	Attribute			
12	customerProvince	char(30)	Attribute			

Table G.2. File Structure of Customers (Continued).

No.	Field Name	Field Type	Key Type	Null	Default	Extra
13	customerCountry	char(30)	Attribute			
14	customerPostalCode	char(20)	Attribute			
15	customerPhone	char(20)	Attribute	Yes	Null	
16	customerFax	char(20)	Attribute			
17	customerEmail	char(50)	Attribute	Yes	Null	
18	customerCCNumber	char(30)	Attribute			
19	customerCCBank	char(30)	Attribute			
20	customerCCExpireDate	date	Attribute			
21	customerCCName	char(60)	Attribute			
22	customerComment	text	Attribute			

Table G.3. File Structure of Product Lines.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	productLineCode	char(2)	Primary Key			
2	productLineName	char(30)	Attribute			
3	productLineDescription	char(50)	Attribute	Yes	Null	

Table G.4. File Structure of Prefers.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	customerTypeCode	char(2)	Primary Key			
2	productLineCode	char(2)	Primary Key			

Table G.5. File Structure of Products.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	productPID	int(10) unsigned	Primary Key			Auto Increment
2	productLineCode	char(2)	Foreign Key			
3	productName	char(30)	Attribute			
4	manufacturerCode	char(20)	Foreign Key			
5	productPrice	float(10,2)	Attribute			
6	productCost	float(10,2)	Attribute			
7	productOnHand	int	Attribute			
8	productOnOrder	int	Attribute			
9	productImage	blob	Attribute			
10	productFeatures	text	Attribute			

Table G.6. File Structure of Orders.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	orderNumber	int(10) unsigned	Primary Key		Null	Auto Increment
2	customerCID	int(10) unsigned	Foreign Key			
3	payOptionCode	char(2)	Foreign Key			
4	deliveryTypeCode	char(2)	Foreign Key			
5	orderSaleDate	date	Attribute			
6	orderDeliveryDate	date	Attribute			
7	staffSID	int(10) unsigned	Attribute			
8	orderShippingName	char(60)	Attribute			
9	orderShippingStreetAddress	char(50)	Attribute			
10	orderShippingDistrict	char(30)	Attribute			
11	orderShippingCity	char(30)	Attribute			
12	orderShippingPostalCode	char(20)	Attribute			

Table G.6. File Structure of Orders (Continued).

No.	Field Name	Field Type	Key Type	Null	Default	Extra
13	orderShippingProvince	char(30)	Attribute			
14	orderShippingCountry	char(30)	Attribute			
15	orderShippingPhone	char(20)	Attribute			
16	orderShippingFax	char(20)	Attribute			
17	orderShippingEmail	char(50)	Attribute			
18	deliveryTypeCode	char(2)	Attribute			
19	orderTerm	char(30)	Attribute			
20	payOptionCode	char(2)	Attribute			
21	orderComment	text	Attribute			
22	orderTotalAmount	float(10,2)	Attribute			
23	orderTaxRate	float(5,2)	Attribute			
24	orderFreight	float(10,2)	Attribute			



Table G.6. File Structure of Orders (Continued).

No.	Field Name	Field Type	Key Type	Null	Default	Extra
25	orderAmountPaid	float(10,2)	Attribute			

Table G.7. File Structure of Order Lines.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	orderNumber	int(10) unsigned	Primary Key			
2	productPID	int(10) unsigned	Primary Key			
3	orderLineQuantity	float(10,2)	Attribute			
4	orderLinePrice	float(10,2)	Attribute			
5	orderLineStatus	char(5)	Attribute			
6	orderLinePickDate	date	Attribute			
7	orderLineDeliveryDate	date	Attribute			
8	orderLineShipNumber	Int(10) unsigned	Attribute			
9	orderLineComment	Text	Attribute			

Table G.8. File Structure of Payment Options.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	payOptionCode	char(2)	Primary Key			
2	payOptionName	char(30)	Attribute			
3	payOptionDescription	char(50)	Attribute	Yes	Null	

Table G.9. File Structure of Delivery Types.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	deliveryTypeCode	char(2)	Primary Key			
2	deliveryTypeName	char(30)	Attribute			
3	deliveryTypeDescription	char(50)	Attribute	Yes	Null	

Table G.10. File Structure of Accesses.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	accessInTime	date	Primary Key			
2	accessIP	char(20)	Attribute			
3	accessOutTime	date	Attribute			

Table G.11. File Structure of Manufacturers.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	manufacturerCode	int(10) unsigned	Primary Key		Null	Auto Increment
2	payOptionCode	char(2)	Foreign Key			
3	manufacturerCompany	char(60)	Attribute	Yes	Null	
4	manufacturerFirstName	char(60)	Attribute			
5	manufacturerLastName	char(60)	Attribute			
6	manufacturerTitle	char(20)	Attribute			
7	manufacturerStreetAddress	char(50)	Attribute			
8	manufacturerDistrict	char(30)	Attribute			
9	manufacturerCity	char(30)	Attribute			
10	manufacturerProvince	char(30)	Attribute			
11	manufacturerCountry	char(30)	Attribute			
12	manufacturerPostalCode	char(20)	Foreign Key			

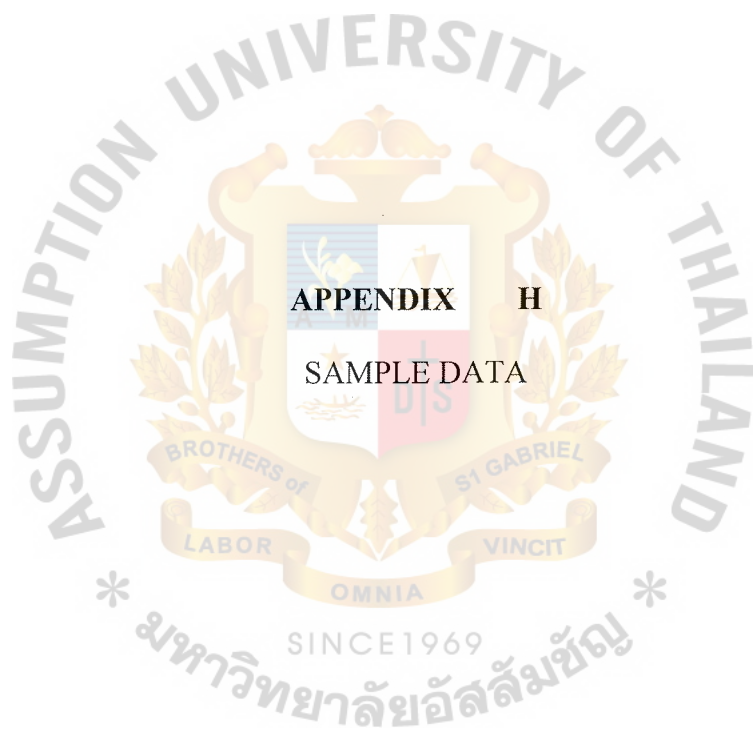
Table G.11. File Structure of Manufacturers (Continued).

No.	Field Name	Field Type	Key Type	Null	Default	Extra
13	manufacturerPhone	char(20)	Attribute	Yes	Null	
14	manufacturerFax	char(20)	Attribute			
15	manufacturerEmail	char(50)	Attribute	Yes	Null	
16	manufacturerComments	text	Attribute			



Table G.12. File Structure of Staffs.

No.	Field Name	Field Type	Key Type	Null	Default	Extra
1	staffSID	int(10) unsigned	Primary Key		Null	Auto Increment
2	staffFirstName	char(60)	Attribute			
3	staffLastName	char(60)	Attribute			
4	staffTitle	char(20)	Attribute			
5	staffPhoneExt	char(5)	Attribute			
6	staffHireDate	date	Attribute			
7	staffSalary	float(10,2)	Attribute			
8	staffImage	blob	Attribute			
9	staffComments	text	Attribute			



APPENDIX H  
SAMPLE DATA

Table H.1.1. Customer Types sample data.

Customer Type Code	Customer Type Name	Customer Type Description
"HM"	"Home/Home offices"	"Families, students and power users"
"LB"	"Large business"	"Business over 400 employees"
"SB"	"Small business"	"Business under 400 employees"

Table H.2. Product Lines sample data.

Product Line Code	Product Line Name	Product Line Description
"DT"	"Desktops"	"Desktops computer"
"NB"	"Notebooks"	"Notebooks computer"
"SV"	"Servers"	"Servers"
"SW"	"Software"	"Computer Software"
"WK"	"Workstations"	"Workstations"

Table H.3. Prefers sample data.

Customer Type Code	Product Line Code
“SB”	“DT”
“SB”	“NB”
“SB”	“SW”

Table H.4. Products sample data.

Product PID	Product Name	Product Line Code	Product Manufacturer	Product Price	Product Image
200890	“Dell Inspiron 7000 Notebooks”	“NB”	“Dell”	135,990	BLOB
200891	“Dell Inspiron 3500 Notebooks”	“NB”	“Dell”	122,580	BLOB
908809	“Adobe Photoshop 7.0”	“SW”	“Adobe”	11,450	BLOB

Table H.5. Orders sample data.

Order Number	Customer CID	Payment Option Code	Order Date	Order Delivery Type
9877745	1290002	"CC"	"Jan-01-2004"	"L"
9877746	1290001	"CC"	"Jan-01-2004"	"L"

Table H.6. Order Lines sample data.

Order Number	Product PID	Order Line Quantity	Order Line Price	Order Line Status
9877745	200890	1	136,080	"S"
9877745	200891	1	123,450	"C"
9877746	200890	2	136,080	"S"
9877746	908809	1	11,450	"S"



Table H.7. Payment Options sample data.

Payment Option Code	Payment Option Name	Payment Option Description
"CC"	"Credit Card"	"Credit Card"
"CH"	"Checks"	"Checks"
"EF"	"Electronic Funds Transfer"	"Electronic Funds Transfer"
"MO"	"Money Orders"	"Money Orders"



## APPENDIX I

### WEB INTERFACE DESIGN

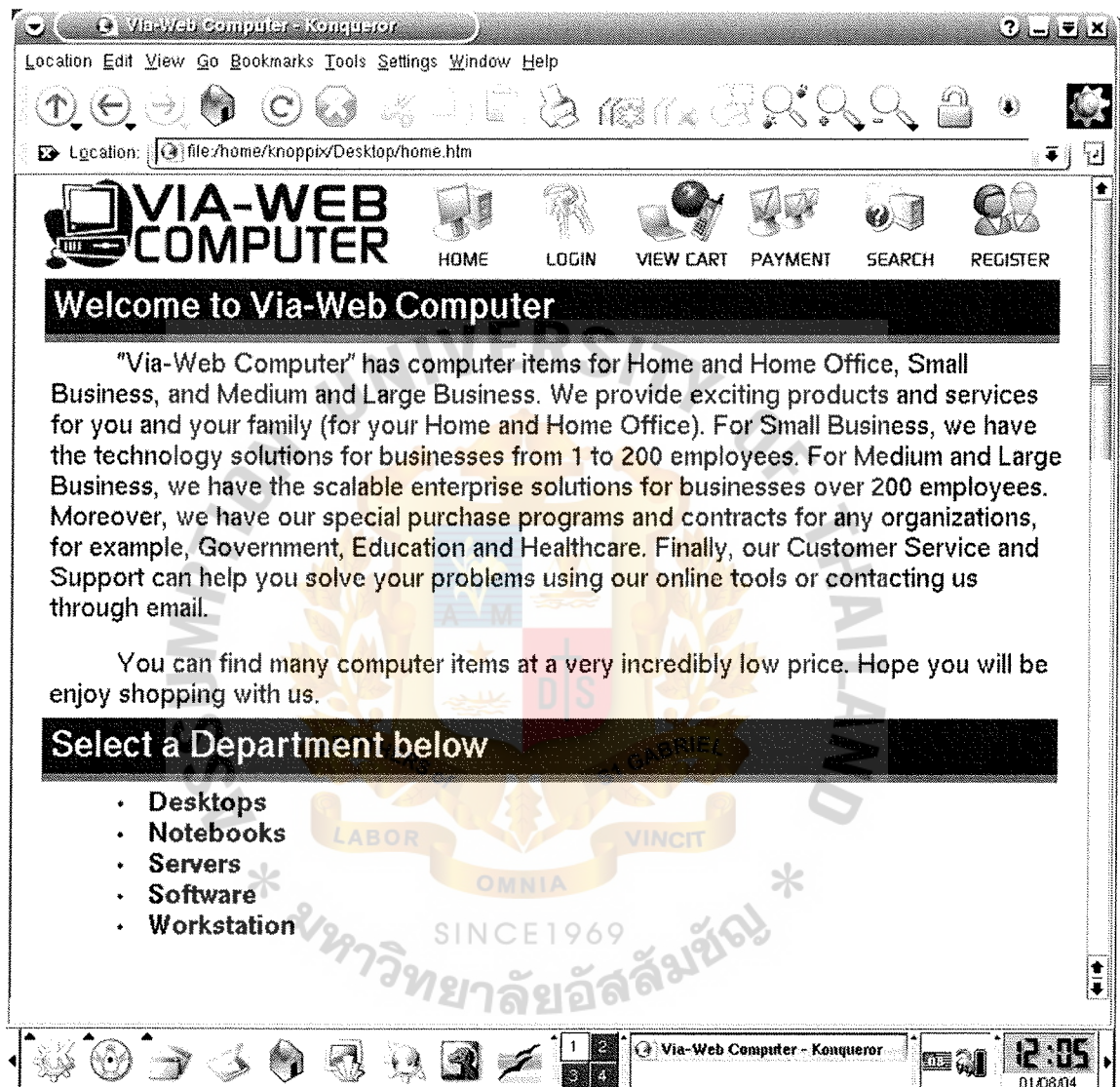


Figure I.1. Web Interface Screen: Home Page.

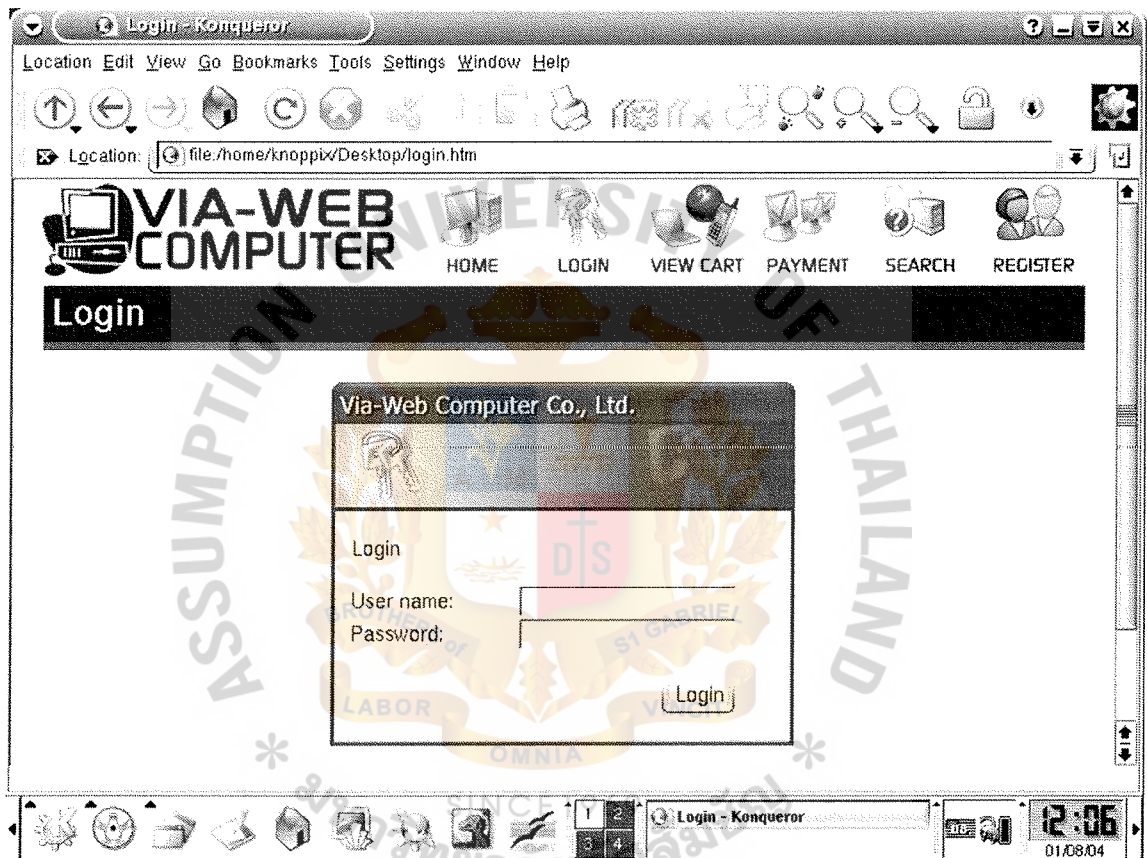


Figure I.2. Web Interface Screen: Login Page.

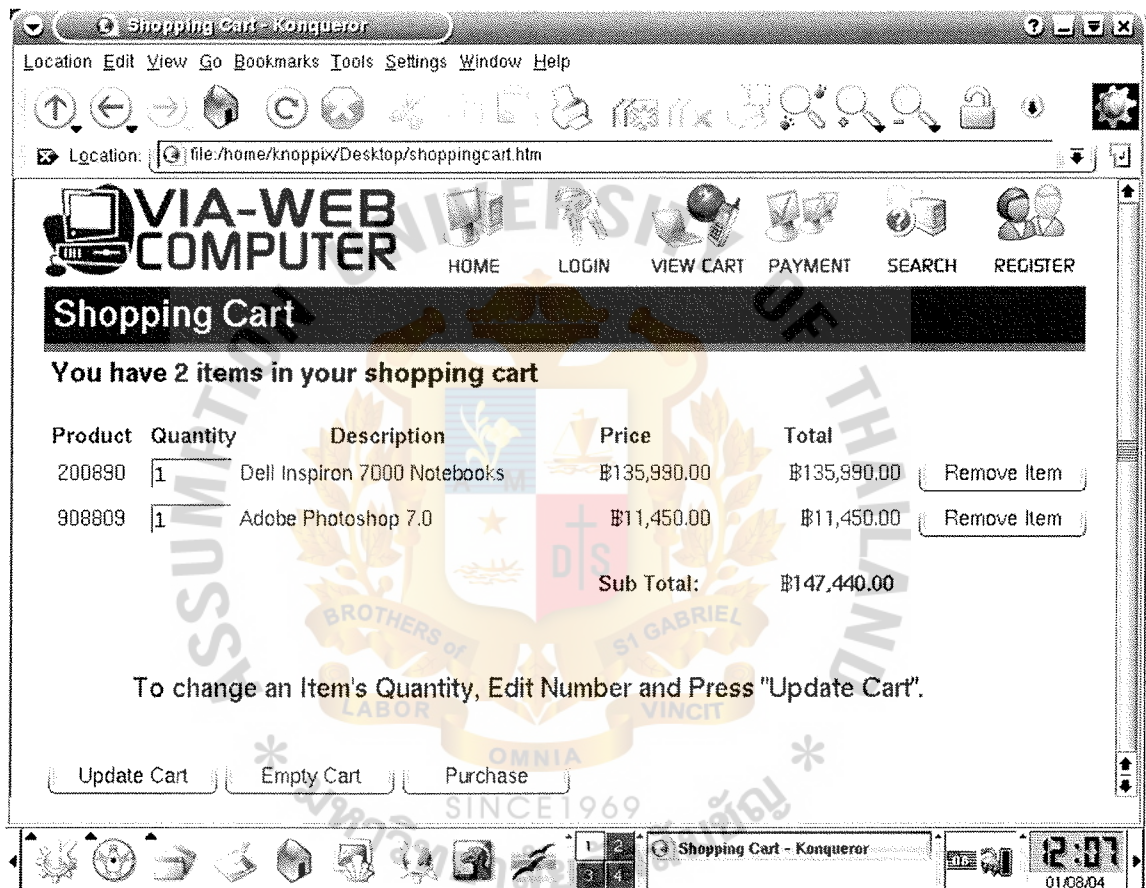


Figure I.3. Web Interface Screen: Shopping Cart.



Payment - Konqueror

Location Edit View Go Bookmarks Tools Settings Window Help

Location: file:/home/knoppix/Desktop/payment.htm

**VIA-WEB COMPUTER** HOME LOGIN VIEW CART PAYMENT SEARCH REGISTER

## Payment

### Shipping Address Information

Customer Code: 129001 Type of Customer: Home/Home offices

Shipping Street Address:

Company Name: District/Tambon: City/Amphor:

Title: First Name: Province/State: Postal Code:

Last Name: Country/Region:

E-mail Address: Telephone Number: Fax Number:

If you need to change any items, please go to the "View Cart" to correct them.

If the order is correct, then please fill out the **Shipping Address Information** above and press the "Total" button. This will show you what your total cost (including tax and shipping) will be. If the total is satisfactory, then you will be able to complete the purchase.

Total Cancel

SINCE 1969 มหาวิทยาลัยอัสสัมชัญ

Payment - Konqueror 12:07 01.08.04

Figure I.4. Web Interface Screen: Payment Form.



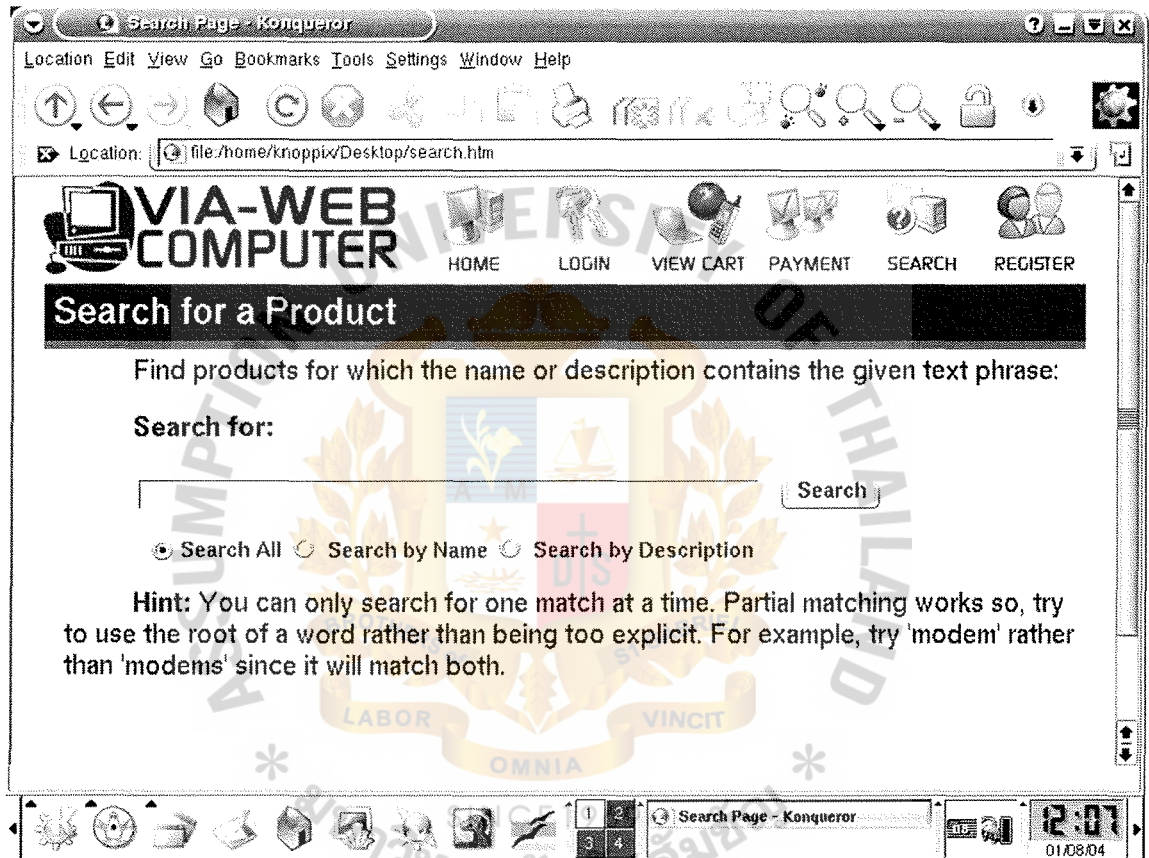


Figure I.5. Web Interface Screen: Search Form.

Customer Registration - Konqueror

Location Edit View Go Bookmarks Tools Settings Window Help

Location: file:/home/knopix/Desktop/customers.htm

**VIA-WEB COMPUTER** HOME LOGIN VIEW CART PAYMENT SEARCH REGISTER

## Customer Registration

### Customer Information

Customer Code: 129001 Type of Customer: Home/Home offices Street Address:

Company Name: District/Tambon: City/Amphor:

Title: First Name: Province/State: Postal Code:

Last Name: Country/Region:

Password: E-mail Address: Telephone Number: Fax Number:

### Payment Options

This customer pays (check all that apply):

☐ Checks ☐ Credit cards ☐ Money orders ☐ Electronic funds transfer

### Credit Card Information

Credit Card Number: Credit Card Bank: Valid Thru: Name Printed on Card:

### Notes

Submit Cancel

1 2 3 4 Customer Registration - Konqueror 12:08 01/08/04

Figure I.6. Web Interface Screen: Customer Registration Form.

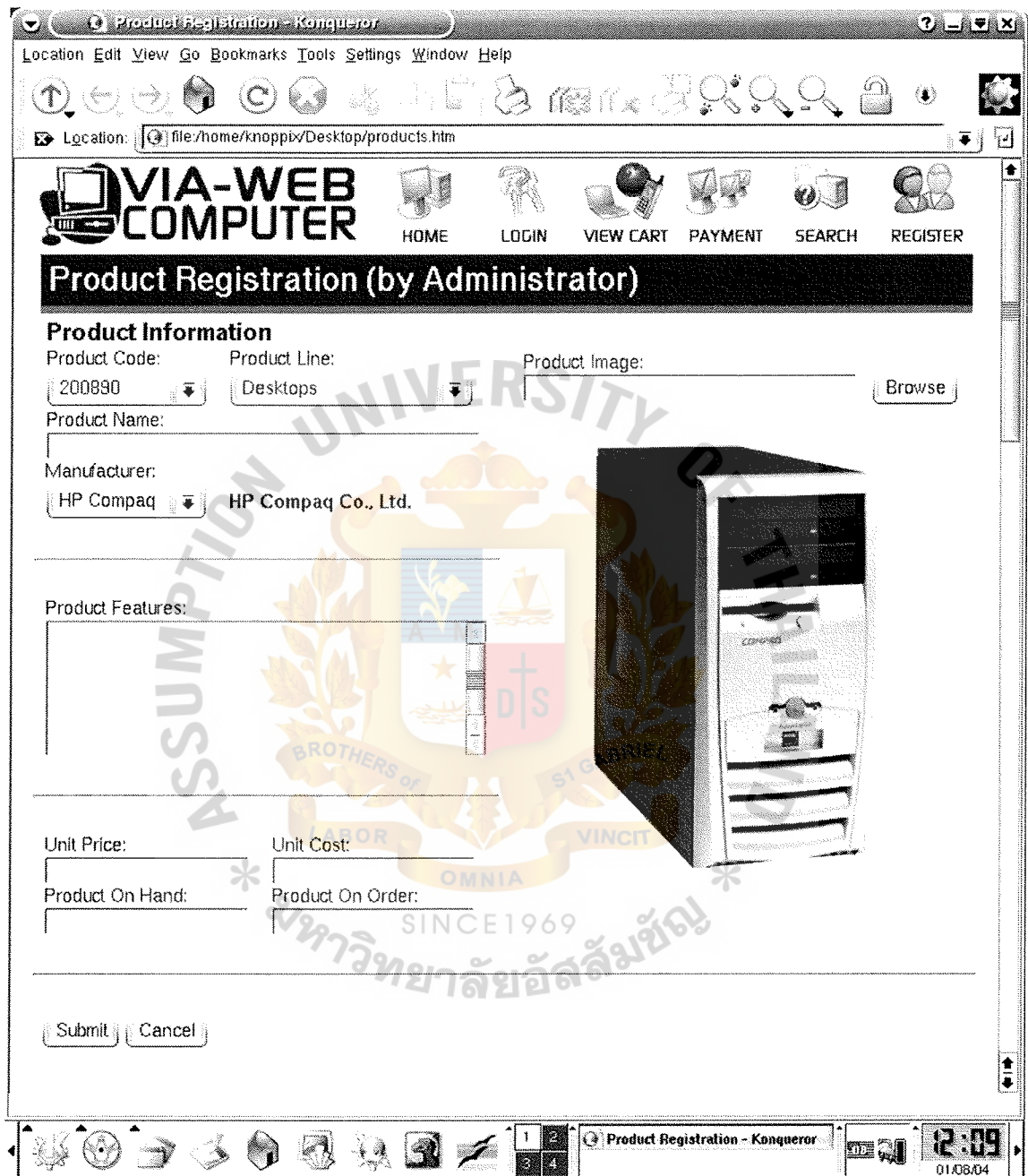


Figure I.7. Web Interface Screen: Product Registration Form.

Manufacturer Registration - Konqueror

Location Edit View Go Bookmarks Tools Settings Window Help

Location: file:/home/knoppix/Desktop/manufacturers.htm

**VIA-WEB COMPUTER** HOME LOGIN VIEW CART PAYMENT SEARCH REGISTER

## Manufacturer Registration (by Administrator)

### Manufacturer Information

Manufacturer: \_\_\_\_\_ Company Name: \_\_\_\_\_ Street Address: \_\_\_\_\_

District/Tambon: \_\_\_\_\_ City/Amphor: \_\_\_\_\_

Province/State: \_\_\_\_\_ Postal Code: \_\_\_\_\_

### Contact Person

Title: \_\_\_\_\_ First Name: \_\_\_\_\_ Country/Region: \_\_\_\_\_

Last Name: \_\_\_\_\_ Telephone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

### Payment Options

This manufacturer accepts (check all that apply):

☐ Checks ☐ Credit cards ☐ Money orders ☐ Electronic funds transfer

### Notes

\_\_\_\_\_

Submit Cancel

1 2 3 4 Manufacturer Registration - Konqueror 12:10 01/08/04

Figure I.8. Web Interface Screen: Manufacturer Registration Form.



Staff Registration - Konqueror

Location Edit View Go Bookmarks Tools Settings Window Help

Location: file:/mnt/hda1/masterProject/webInterface/staff.htm

**VIA-WEB COMPUTER** HOME LOGIN VIEW CART PAYMENT SEARCH REGISTER

### Staff Registration (by Administrator)

#### Staff Information

Staff Code: 99001 Title:

First Name:

Last Name:

Phone Extention: Hire Date:

Salary:

#### Notes

Submit Cancel

9:21 03/16/04

Figure I.9. Web Interface Screen: Staff Registration Form.



**APPENDIX J**  
**REPORT DESIGN**





DATE: 1/8/2004 1:01:29 AM

Customer #: 129001

**Shipping Information**

Kasem Khasemputtaruengsri  
36/1 Soi Sapanku, Rama 4 Road  
Thungmahamek, Sathorn  
Bangkok 10120  
TH  
Daytime Phone: +6626797825  
Email: kasem@ttaa.org

**Billing Information**

Kasem Khasemputtaruengsri  
36/1 Soi Sapanku, Rama 4 Road  
Thungmahamek, Sathorn  
Bangkok 10120  
TH  
Daytime Phone: +6626797825  
Email: kasem@ttaa.org

Paid: Visa – Exp. 3/2005

<u>Product</u>	<u>Description</u>	<u>Unit Price</u>	<u>Quantity</u>	<u>Total Price</u>
200890	Dell Inspiron 7000 Notebooks	B135,990.00	1	B135,990.00
902209	Adobe Photoshop 7.0	B11,450.00	1	B11,450.00
Subtotal:				B147,440.00
Shipping & Handling:				B0.00
Tax:				B0.00
Total (Baht):				B147,440.00

Figure J.1. Report Design: Receipt Report.



Visitor Access List

DATE: 3/18/2004 1:01:29 AM

Page 1 of 2

<u>Access No.</u>	<u>IP Address</u>	<u>Timestamp</u>	<u>online</u>
100890	203.107.212.33	Mar 17, 21:15:26	0:06:19
100891	208.147.1.1	Mar 17, 21:07:37	0:00:08
100892	203.113.36.13	Mar 17, 20:31:57	0:14:17
100893	ppp-203.144.144.186.revip.asianet.co.th	Mar 17, 20:12:23	0:03:23
100894	ppp-203.144.192.174.revip.asianet.co.th	Mar 17, 19:52:15	0:01:42
100895	203.155.183.138	Mar 17, 19:15:25	0:11:12
100896	203.113.32.10	Mar 17, 19:02:48	0:16:54
100897	192.168.32.73	Mar 17, 19:01:32	0:15:30
100898	203.113.41.103	Mar 17, 18:54:44	0:02:23
100899	ppp-203.144.183.117.revip.asianet.co.th	Mar 17, 18:19:49	0:11:56
100900	203.113.76.12	Mar 17, 18:09:15	0:02:35
100901	10.10.9.102	Mar 17, 17:37:59	0:30:14
100902	203.209.103.76	Mar 17, 17:17:50	0:10:00
100903	proxy1.chula.ac.th	Mar 17, 17:03:01	0:08:02
100904	ppp-210.86.131.96.revip.asianet.co.th	Mar 17, 16:59:53	0:01:41
100905	210.177.114.243	Mar 17, 16:34:19	0:47:29
100906	202.28.25.45	Mar 17, 16:26:23	0:02:06
100907	203.148.176.141	Mar 17, 16:14:01	0:00:59
100908	208.147.1.1	Mar 17, 16:05:04	0:13:12
100909	61.19.193.47	Mar 17, 15:37:16	0:00:48
100910	192.150.249.84	Mar 17, 15:34:18	0:00:45
100911	203.155.9.138	Mar 17, 15:31:25	0:08:19
100912	proxy1.chula.ac.th	Mar 17, 15:30:08	0:13:13
100913	10.193.199.60	Mar 17, 15:25:19	0:25:38
100914	208.147.1.1	Mar 17, 15:23:09	0:04:26
100915	203.146.79.204	Mar 17, 15:19:33	0:21:22
100916	ppp-203.144.211.115.revip.asianet.co.th	Mar 17, 15:10:45	0:33:59
100917	203.147.4.193	Mar 17, 14:54:17	0:03:42
100918	ppp-203.144.192.174.revip.asianet.co.th	Mar 17, 14:52:00	0:03:41
100919	203.107.212.33	Mar 17, 14:50:44	0:06:23
100920	208.147.1.1	Mar 17, 14:49:09	0:15:50
100921	203.113.36.13	Mar 17, 14:44:52	0:06:41
100922	10.9.9.36	Mar 17, 14:42:00	0:01:17
100923	10.0.250.89	Mar 17, 14:27:20	0:07:13
100924	ppp-203.144.144.186.revip.asianet.co.th	Mar 17, 14:26:48	0:22:15
100925	129.0.1.30	Mar 17, 14:26:06	0:06:38
100926	208.147.1.1	Mar 17, 14:23:10	0:04:03

Figure J.2. Report Design: Visitor Access List.



Payment Transaction Report

DATE: 3/18/2004 1:01:29 AM

Page 1

<u>Bill No.</u>	<u>Payment</u>	<u>Receipt No.</u>	<u>Amount</u>	<u>Shipping</u>	<u>Tax</u>	<u>Total Amount</u>
12003	Credit	996519	B147,440.00	B1,000.00	B14,744.00	B163,184.00
12004	Credit	996520	B11,450.00	B1,000.00	B1,145.00	B13,595.00
12005	Credit	996521	B65,890.00	B1,000.00	B6,589.00	B73,479.00
12006	Credit	996522	B127,510.00	B1,000.00	B12,751.00	B141,261.00
12007	Credit	996523	B182,900.00	B1,000.00	B18,290.00	B202,190.00
12008	Credit	996524	B100,970.00	B1,000.00	B10,097.00	B112,067.00
12009	Credit	996525	B51,240.00	B1,000.00	B5,124.00	B57,364.00
12010	Credit	996526	B156,320.00	B1,000.00	B15,632.00	B172,952.00
12011	Credit	996527	B23,510.00	B1,000.00	B2,351.00	B26,861.00
12012	Credit	996528	B15,630.00	B1,000.00	B1,563.00	B18,193.00
12013	Credit	996529	B136,880.00	B1,000.00	B13,688.00	B151,568.00
12014	Credit	996530	B181,760.00	B1,000.00	B18,176.00	B200,936.00
12015	Credit	996531	B12,720.00	B1,000.00	B1,272.00	B14,992.00
12016	Credit	996532	B181,800.00	B1,000.00	B18,180.00	B200,980.00
12017	Credit	996533	B60,400.00	B1,000.00	B6,040.00	B67,440.00
12018	Credit	996534	B109,410.00	B1,000.00	B10,941.00	B121,351.00
12019	Credit	996535	B50,900.00	B1,000.00	B5,090.00	B56,990.00
12020	Credit	996536	B23,510.00	B1,000.00	B2,351.00	B26,861.00
12021	Credit	996537	B186,300.00	B1,000.00	B18,630.00	B205,930.00
12022	Credit	996538	B156,320.00	B1,000.00	B15,632.00	B172,952.00
12023	Credit	996539	B100,500.00	B1,000.00	B10,050.00	B111,550.00
12024	Credit	996540	B122,000.00	B1,000.00	B12,200.00	B135,200.00
12025	Credit	996541	B16,040.00	B1,000.00	B1,604.00	B18,644.00
12026	Credit	996542	B863,000.00	B1,000.00	B86,300.00	B950,300.00
12027	Credit	996543	B115,630.00	B1,000.00	B11,563.00	B128,193.00
12028	Credit	996544	B33,940.00	B1,000.00	B3,394.00	B38,334.00
12029	Credit	996545	B16,640.00	B1,000.00	B1,664.00	B19,304.00
12030	Credit	996546	B160,410.00	B1,000.00	B16,041.00	B177,451.00
12031	Credit	996547	B231,530.00	B1,000.00	B23,153.00	B255,683.00
12032	Credit	996548	B63,200.00	B1,000.00	B6,320.00	B70,520.00
12033	Credit	996549	B152,350.00	B1,000.00	B15,235.00	B168,585.00
12034	Credit	996550	B21,660.00	B1,000.00	B2,166.00	B24,826.00
12035	Credit	996551	B166,160.00	B1,000.00	B16,616.00	B183,776.00
12036	Credit	996552	B45,920.00	B1,000.00	B4,592.00	B51,512.00

Grand Total: B4,091,840.00 B34,000.00 B409,184.00 B4,536,024.00

Figure J.3. Report Design: Payment Transaction Report.



Product Line List

DATE: 3/18/2004 1:01:29 AM

Page 1

<u>No.</u>	<u>Product Line Code</u>	<u>Product Line Name</u>	<u>Product Line Description</u>
1.	DT	Desktops	Desktops computer
2.	NB	Notebooks	Notebooks computer
3.	SV	Servers	Servers
4.	SW	Software	Computer Software
5.	WK	Workstations	Workstations



Figure J.4. Report Design: Product Line List.



# Product Report

DATE: 3/18/2004 1:01:29 AM

Page 1

<u>Product No.</u>	<u>Product Name</u>	<u>Product Line</u>	<u>Manufacturer</u>	<u>Price</u>	<u>Cost</u>	<u>Stock</u>
100710	HP Pavilion 450	DT	HP	100,990	90,891	7
100711	HP Pavilion 410	DT	HP	98,920	89,028	9
100712	HP Pavilion 320	DT	HP	95,120	85,608	5
100713	HP Pavilion 300	DT	HP	90,990	81,891	7
100714	HP Pavilion 250	DT	HP	87,570	78,813	8
100715	HP Pavilion 200	DT	HP	85,580	77,022	9
200890	Dell Inspiron 7000	NB	Dell	148,990	134,091	9
200891	Dell Inspiron 6500	NB	Dell	145,580	131,022	6
200892	Dell Inspiron 6200	NB	Dell	144,990	130,491	3
200893	Dell Inspiron 6000	NB	Dell	142,975	128,678	7
200894	Dell Inspiron 5800	NB	Dell	140,080	126,072	9
200895	Dell Inspiron 5500	NB	Dell	139,120	125,208	5
200896	Dell Inspiron 5200	NB	Dell	135,920	122,328	3
200897	Dell Inspiron 5000	NB	Dell	132,990	119,691	4
200898	Dell Inspiron 4800	NB	Dell	130,450	117,405	2
200899	Dell Inspiron 4500	NB	Dell	128,580	115,722	8
200900	Dell Inspiron 4000	NB	Dell	125,990	113,391	8
200901	Dell Inspiron 3500	NB	Dell	122,580	110,322	5
908809	Adobe Photoshop 7.0	SW	Adobe	11,450	10,305	9
908810	Adobe Photoshop 6.5	SW	Adobe	10,450	9,405	9
908811	Adobe Photoshop 6.0	SW	Adobe	9,450	8,505	8
908812	Adobe Photoshop 5.0	SW	Adobe	8,450	7,605	9
908813	Adobe Page Maker 6.0	SW	Adobe	15,120	13,608	9
908814	Adobe Page Maker 5.5	SW	Adobe	13,120	11,808	5
908815	Adobe Page Maker 5.0	SW	Adobe	12,120	10,908	5
908816	Adobe Premiere 6.5	SW	Adobe	18,900	17,010	3
908817	Adobe Premiere 6.0	SW	Adobe	17,900	16,110	4
908818	Adobe Premiere 5.0	SW	Adobe	16,900	15,210	4
908819	Microsoft Windows 2003	SW	Microsoft	22,120	19,908	6
908820	Microsoft Windows 2000	SW	Microsoft	20,120	18,108	7
908821	Microsoft Windows XP	SW	Microsoft	21,720	19,548	6
908822	Microsoft Office 2003	SW	Microsoft	15,270	13,743	6
908823	Microsoft Office XP	SW	Microsoft	12,270	11,043	9
908824	Microsoft Office 2000	SW	Microsoft	10,270	9,243	8

Grand Total: 2,433,045 2,189,741 221

Figure J.5. Report Design: Product Report.



Payment Options Report

DATE: 3/18/2004 1:01:29 AM

Page 1

<u>No.</u>	<u>Payment Code</u>	<u>Payment Name</u>	<u>Description</u>
1.	CC	Credit Card	Credit Card
2.	CH	Checks	Checks
3.	EF	Electronic Funds Transfer	Electronic Funds Transfer
4.	MO	Money Orders	Money Orders



Figure J.6. Report Design: Payment Options Report.



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